Compressed Air Magazine

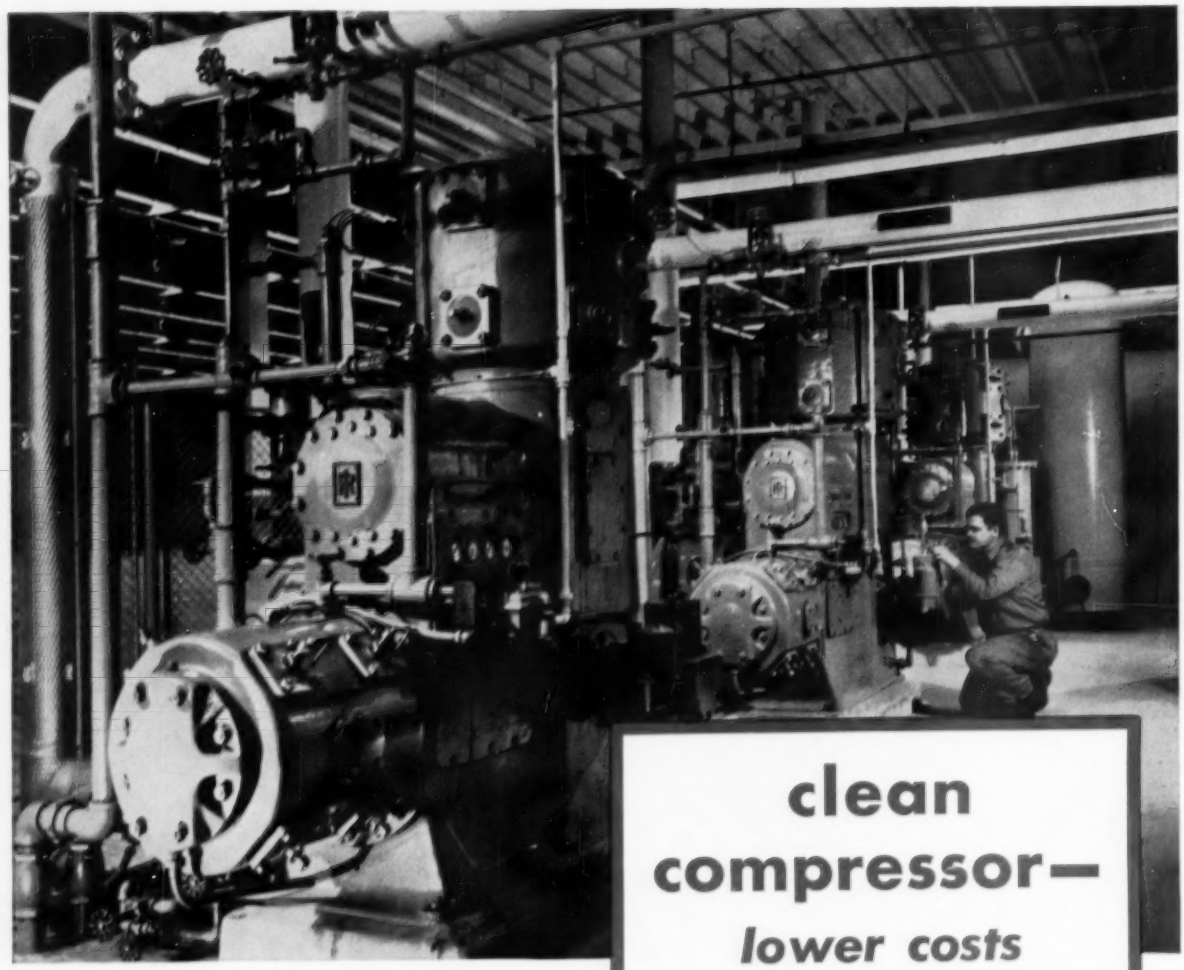
OCTOBER 1957

PRISTINE VILLAGE, RUGGED MOUNTAINS

Picturesque town, modern electric rails nestle in Lepontine Alps

(SEE INDEX PAGE AND PAGE 298)

VOLUME 62 • NUMBER 10 NEW YORK • LONDON



clean compressor— *lower costs*

Maintenance costs go down when your air compressors are lubricated with oil that keeps the system clean. *Texaco Regal Oil R&O* is especially designed to keep out harmful deposits and rust. This protects you against costly downtime and repairs. Maintenance costs are kept down.

Texaco Regal Oil R&O is a premium quality oil with high lubricating qualities. It is further improved with selected additives. The result is a lubricant that keeps rings free and valves and lines clean. You get full compressor efficiency.

There is a complete line of *Texaco Regal Oils R&O;* and there is one that is exactly right for your system, your operating conditions.

For help in selecting the proper one, call on your Texaco Lubrication Engineer. He is available by calling the nearest of more than 2,000 Texaco Distributing Plants in the 48 States. Or write:

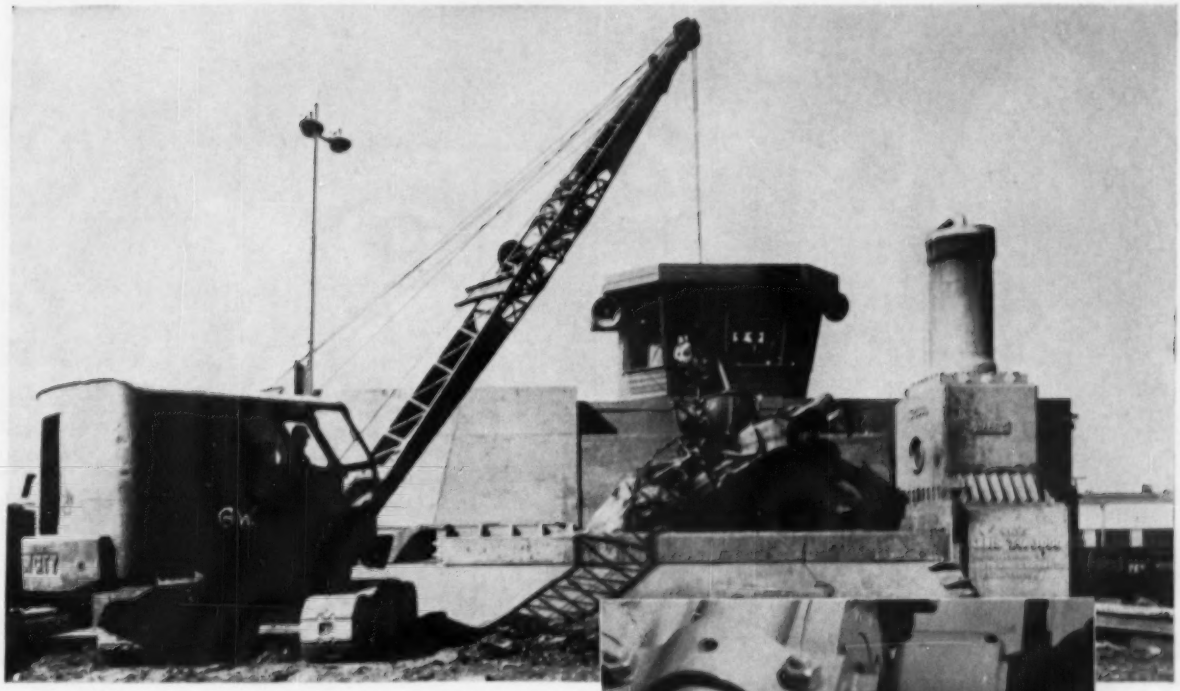
The Texas Company, 135 East 42nd Street, New York 17, N.Y.

TEXACO

TEXACO Regal Oils R&O

FOR ALL AIR COMPRESSORS AND OPERATING CONDITIONS

Circle 13 on reply card



A complete automobile (less wheels and motor), above, being lowered into charging chamber of Harris TG-3000 baling press. Inset, right, shows closeup of Staynew air-intake filter, Model C, whose function on TG-3000 is to prevent contamination of oil by dust in incoming air, as reservoir-oil level varies.

Harris 'PUTS THE SQUEEZE' on Metals . . . and Filter Maintenance

The Harris Foundry and Machine Company, Cordele, Ga., is renowned for the size and power of the monstrous baling presses it manufactures for scrap metal dealers.

One of the latest presses, the Model TG-3000, weighs 315 tons, and in its charging chamber can crush a complete automobile (less wheels and motor) into a compact bale of 2,500 pounds, and measuring only 24″ x 24″ x 60″.

So great is its size that the TG-3000 requires four railway flatcars to move it disassembled.

It has its own power plant and control booth, with a public address system linking inside control operators with those working outside on cranes and related equipment.

The TG-3000 operates on hydraulic principles, using oil rather than water as its displacement or pressure medium. Staynew air-intake filters, Model C, are standard equipment not only on the TG-3000, but on other Harris presses as well. The function of the filters is to prevent contamination of the oil, by cleaning the incoming air.

Available performance data indicated maintenance is not required oftener than every six months.

The Staynew Model C filter is a small-capacity, air-intake filter—inexpensive but efficient—of the same general construction and application as larger Staynew models. The housing is of aluminum with scientifically designed louvres and openings at the base that distribute air evenly over the entire area of the filtering medium. A single through bolt holds the assembly together, making cleaning and inspection fast and simple.

Whatever your filtering problems, there's a Dollinger representative ready to help solve it. Write today and ask. Dollinger Corporation, 7 Centre Park, Rochester 3, N.Y.

MFG. PROTECTOMOTOR U.S. PAT. OFF.

STAYNEW DOLLINGER

FILTERS

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS HIGH PRESSURE FILTERS • AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

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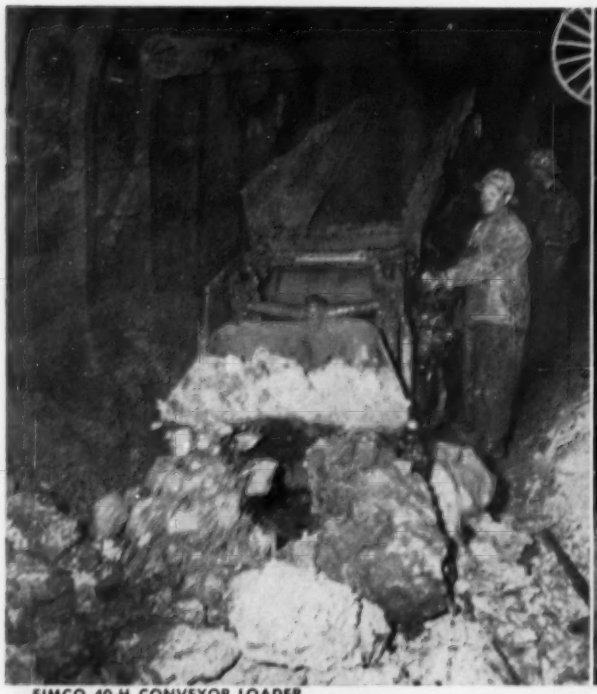
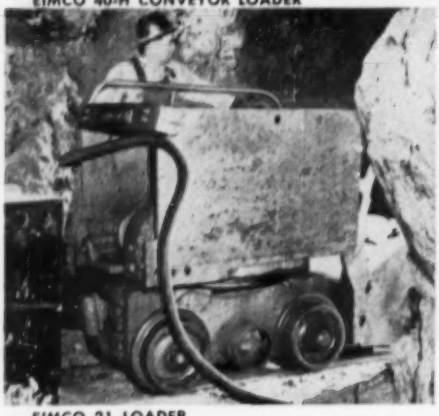
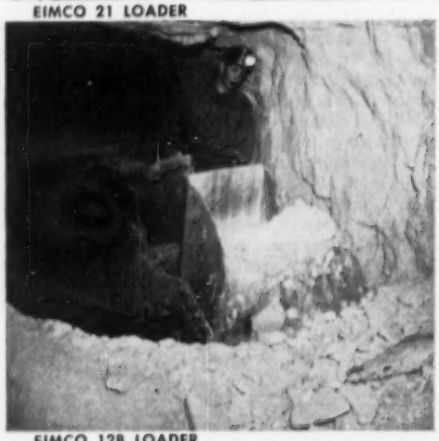


EIMCO 40-H CONVEYOR LOADER

EIMCO 630 TRACTOR-LOADER



EIMCO 21 LOADER



EIMCO 12B LOADER

Crawler or Rail Mounted . . .

There s An Eimco Mucking Machine For Your Drift and Mining System

An Eimco 630 Tractor-Loader mucked inside an 18′ circular shaft in Wyoming and a large rectangular shaft in West Virginia. On basis of its performance, it was publicized as follows: "This machine maneuvers well in confined space and readily loads into shaft buckets. It seems to offer many advantages in shaft mucking, loads faster than a clamshell and is safer to operate".

In Eastern U. S., an Eimco 21 rail-mounted loader was instrumental in the early completion of a 6250′ x 8′ diameter tube that will bring fresh offshore water from a lake to city mains. It worked around the clock, tossing 30 yard rounds of rock (brought down 6 times every working day) over its back into 1 yard end-dump cars.

Operating in rock development work for a large German mining firm, 5 Eimco 40-H rail-mounted conveyor loaders have driven 12½ miles with a combined downtime equivalent to less than two working days.

In England, rail-mounted 12 B's - Eimco's smallest mechanical loader — muck slate in a small diameter heading. The discovery: "Loading with Eimco 12 B's has many advantages over chute and grizzly system. It's faster, safer and more economical".

In mining and tunneling operations throughout the world, Eimco mucking machines continue to establish new production records under tough, grueling service.

There are many profitable reasons for specifying Eimcos when you buy your next mucking machines. And there's an Eimco type and size of mucker to meet your drift and mining system needs. Write today for full information.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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B-280

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Compressed Air Magazine

Founded 1896

VOLUME 62 NUMBER 10

October 1957

R. J. Nemmers, *Editor*
S. M. Parkhill, *Assistant Editor*
C. H. Vivian, *Contributing Editor*
D. Y. Marshall, *Europe*,
243 Upper Thames St., London, E.C. 4.
F. A. McLean, *Canada*,
New Birks Building, Montreal, Quebec

PHOTO, SWISS NATIONAL TOURIST OFFICE

ON THE COVER

WENDING its way through the town of Wassen, in the Swiss Canton of Uri, an electric-driven locomotive of the Swiss Federal Railroad is heading towards Göschenen and the northern entrance of the St. Gotthard Tunnel. It was not far from here that, interwoven with the legend and tradition of William Tell's shooting an apple from his son's head, the Swiss Confederation was born. Of the Canton's some 400 square miles, only about 200 square miles are productive—the lowest figure in the confederation. A portion of the unproductive area is occupied by Lake Lucerne, and 22 percent of it is covered with glacier.

FEATURE ARTICLES

Page 290 **A Bank in Downtown Manhattan**—*R. J. Nemmers*
What may well be the biggest hole ever dug in honeycombed Manhattan Island is rapidly taking shape as the Chase Manhattan Bank undertakes the construction of a new head office building in the Wall Street area. Novel construction methods are being used for a structure that will be a novelty in staid downtown Manhattan.

298 **From Airolo to Göschenen**—*S. M. Parkhill*
Although not as famous as the tunnel under Mount Cenis, the one at St. Gotthard Pass in Switzerland represented a major step forward in the use of air power in tunneling. On the occasion of its seventy-fifth anniversary year, this article details some of the problems encountered in driving the bore, and describes some of the early pneumatic drills and compressors.

304 **A Twentieth Century Ark**—*Peter Sleight*
Oversized, air-filled doughnuts support a new type of off-the-road truck now available for civilian use.

306 **World's Largest World**

306 **Doing Something about the Weather**

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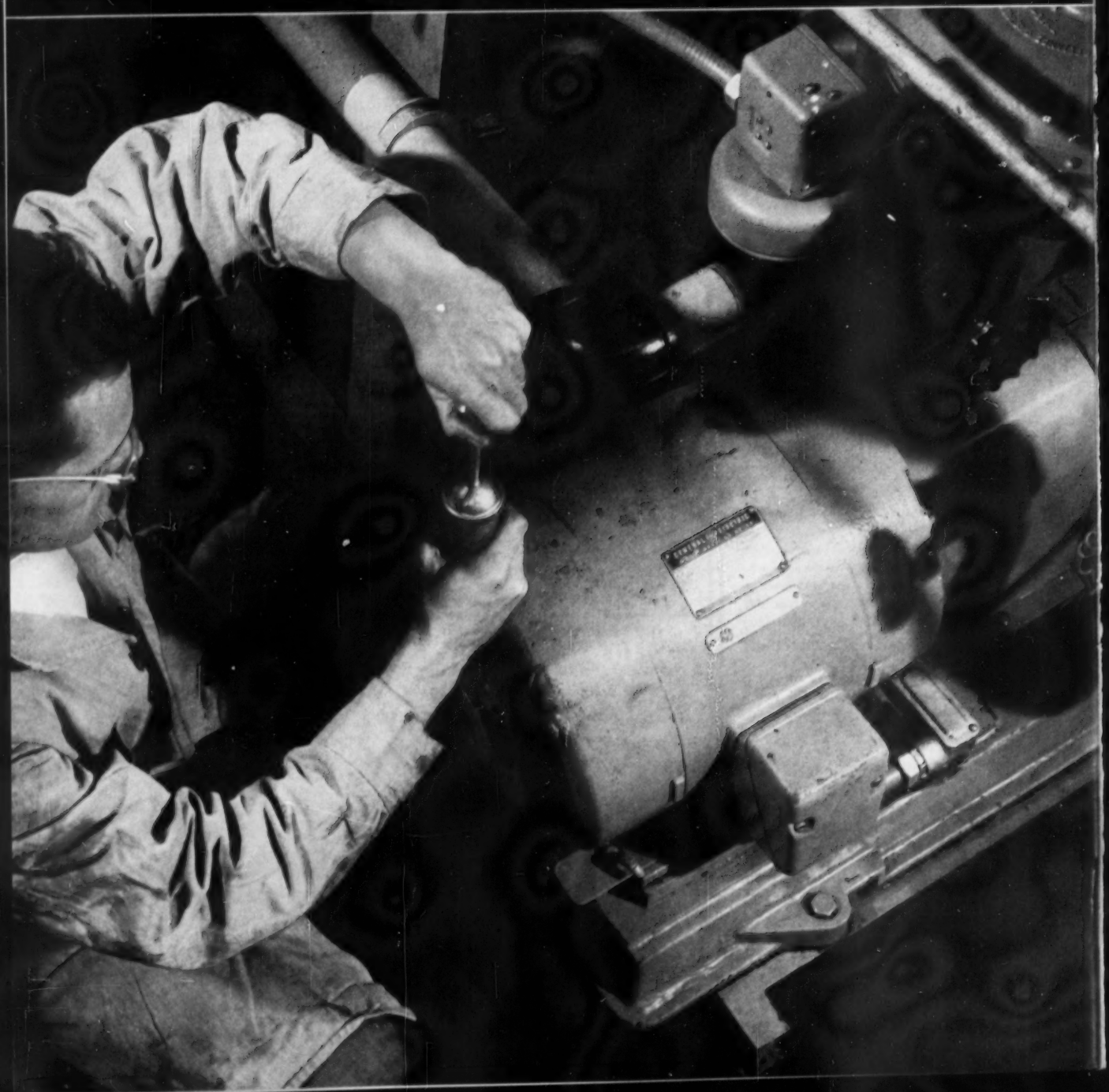
compact . . . power-packed

New General Electric

NOW EASIER

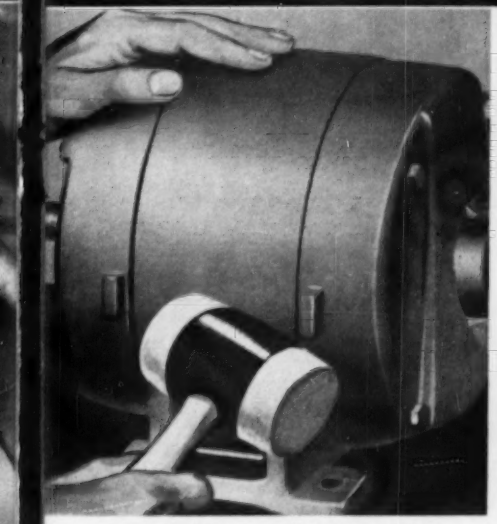
COMPLETE LINE AVAILABLE



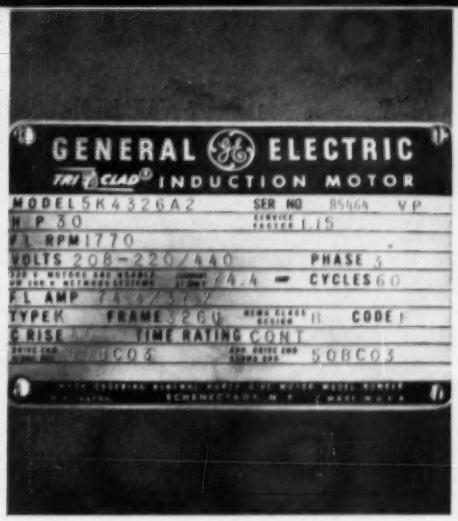
TRI 55 CLAD Motors are . . .

TO MAINTAIN

THROUGH 125-HORSEPOWER



FAST END-SHIELD REMOVAL is possible because of Tri-Clad '55' motor's rugged knock-off lugs. Remove four bolts, tap on knock-off lugs and end-shield is off to permit easy repositioning or quick motor inspection.



EASIER TO MAINTAIN, Tri-Clad '55' motors utilize a stainless-steel, non-corrosive nameplate to give complete rating information including AFMBA bearing numbers. Separate steel plate gives connection diagrams.

EASIER TO INSTALL, Tri-Clad '55' motors use Perma-numbered leads to simplify wiring, speed motor hook-up. Numbers are stamped on terminals and printed on every half-inch of Geoprene® leads.

immediate shipment . . . all ratings

The need for faster production schedules and reduced production costs has made motor maintenance of prime concern to motor users. Modern motors must be easy to inspect and maintain without loss of production time due to routine maintenance.

TO MEET THIS NEED, G-E Tri-Clad '55' motors feature an oversize grease reservoir which contains enough grease for normal 5-year operation. Yet, new grease can be added while the motor is running. Other easy maintenance features are described above.

EASE OF MAINTENANCE, however, is not the whole Tri-Clad '55' motor story. Experienced G-E motor engineers have used revolutionary materials and the most modern production and testing facilities to provide a motor that is not only easier to maintain, but also more reliable and easier to install.

Formerly available only to 30-hp, these proven Tri-Clad '55' motors are now available for immediate shipment—usually from nearby warehouse stocks—up through 125-hp.

FOR FULL INFORMATION on the complete Tri-Clad '55' motor line contact your nearest G-E Apparatus Sales Office or Distributor.

Section J891-7
GENERAL ELECTRIC COMPANY
Schenectady 5, New York

Please send me the following publications:

☐ **FREE BULLETIN (GEA-6602) describes advanced features of new Tri-Clad '55' motors through 125-hp.**

☐ **FREE SLIDE RULE (GEN-148) to determine weight and space-saving benefits of new Tri-Clad '55' motors.**

NAME _____

TITLE _____

COMPANY _____

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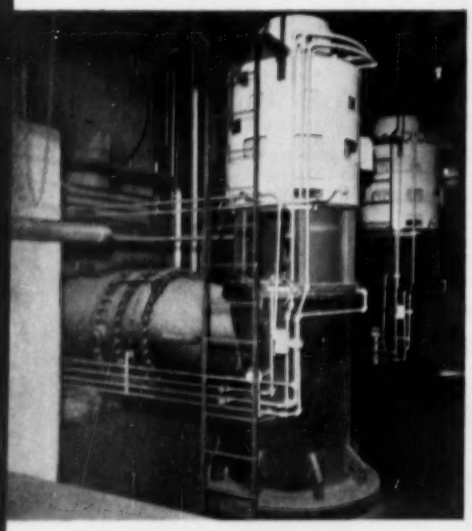
CITY & STATE _____

Progress Is Our Most Important Product

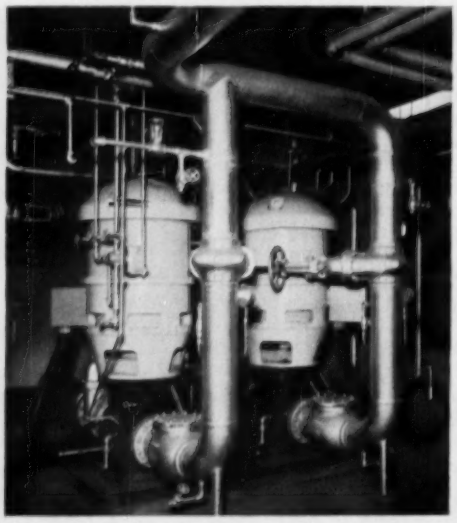
GENERAL ELECTRIC

Ingersoll-Rand
power plant equipment

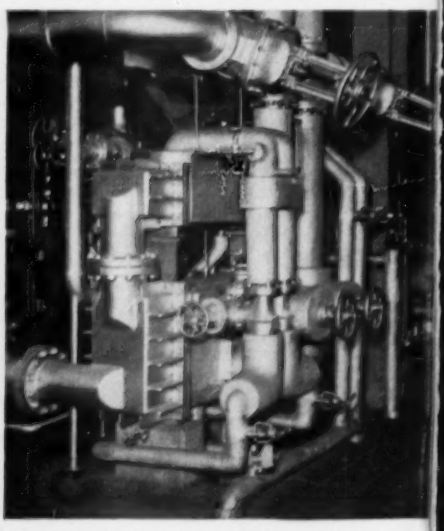
CONDENSER. Space-saving Ingersoll-Rand rectangular condenser, with 75,000 sq ft of cooling surface, serves the bottom-exhaust steam turbine for the 100,000-kw generating unit at this large, modern steam plant.



CIRCULATING PUMPS. Two Ingersoll-Rand Class APM vertical circulating pumps, each with capacity of 32,500 gpm, handle the condenser cooling water.



CONDENSATE PUMPS. The condenser is also served by two Ingersoll-Rand Class APHC vertical hot-well pumps, each handling 1400 gpm of condensate.



STEAM-JET EJECTOR. This Ingersoll-Rand two-stage steam-jet ejector is used to evacuate the condenser of all air and non-condensible gases.

How Another Central Station Profits with

MATCHED PERFORMANCE

of POWER-PLANT EQUIPMENT

by **Ingersoll-Rand**

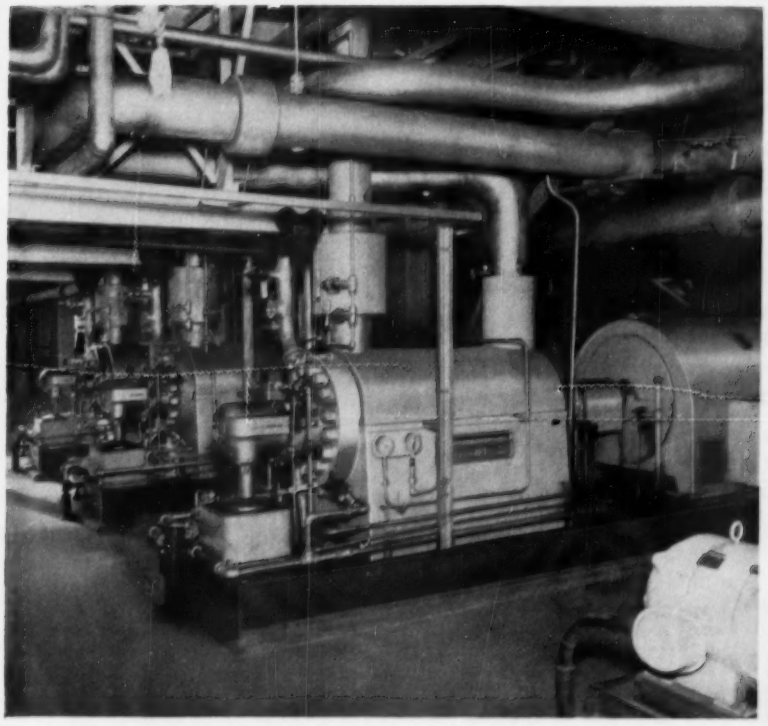
All of the Ingersoll-Rand equipment shown here is installed in a single large utility steam plant.

The condenser, circulating pumps, condensate pumps, ejectors and boiler-feed pumps are designed and built for matched performance — matched to each other and to the job. Functional coordination of these elements is vital to the economy and continuity of the steam generating cycle. And by entrusting the undivided responsibility for their design and construction to I-R power plant equipment specialists, the user is assured of maximum efficiency and dependability in continuous, heavy-duty service.

The compressed air equipment, too — for soot blowing and instrument air — plays an important role. Although basically unrelated to each other, these compressors are matched to the job — designed to give top performance and economy under actual plant conditions.

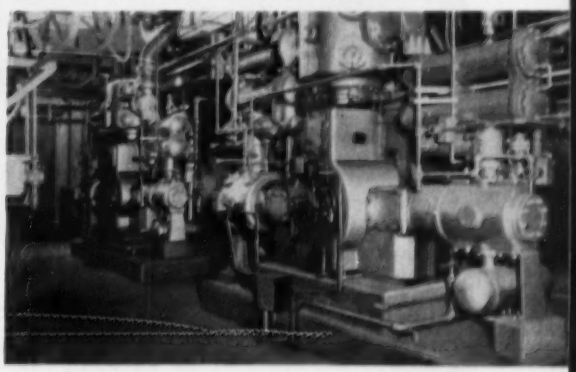
Whatever your power plant requirements — for condensers, pumps, vacuum equipment and compressors — be sure to contact your Ingersoll-Rand representative. His specialized experience in product and application engineering can save you time, effort and expense in meeting your exact requirements to best advantage. Ingersoll-Rand, 11 Broadway, New York 4, N. Y.

14-679

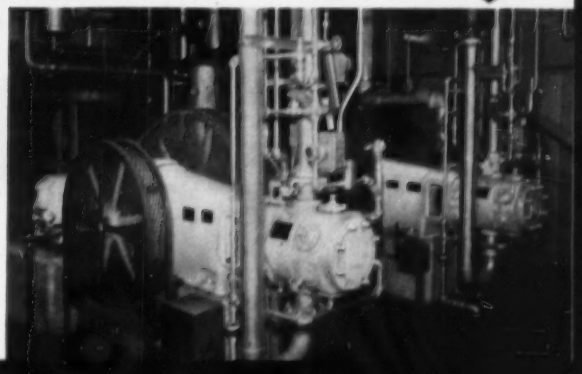


BOILER-FEED PUMPS. Three Ingersoll-Rand Class CHTA boiler-feed pumps, with double-case construction and "unit-type" rotor assembly, each handle 990 gpm at 2300 psi discharge pressure.

SOOT BLOWING COMPRESSORS. Two I-R three-stage TVH compressors with direct-connected motor drive provide high-pressure air for soot-blowing.

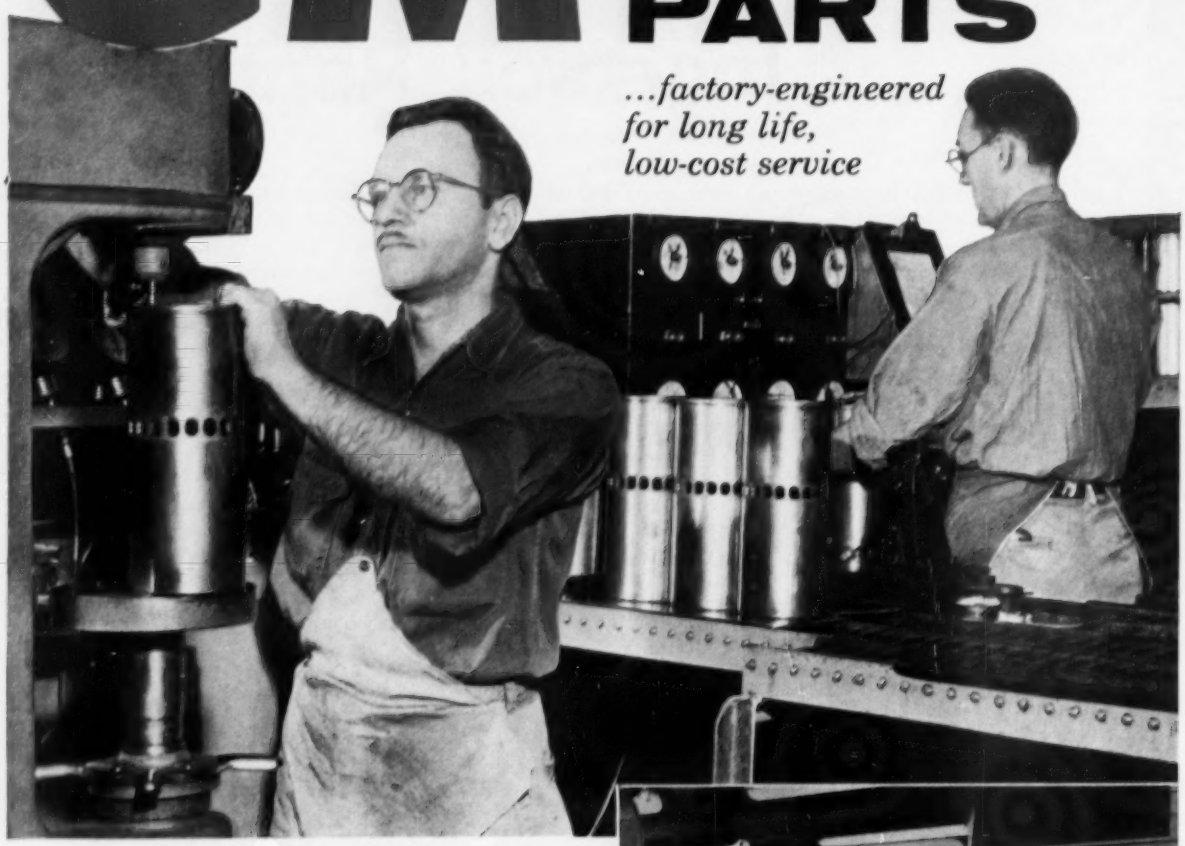


INSTRUMENT AIR. Two I-R ES-NL compressors with non-lubricated cylinders provide oil-free air for instrument control.



GM DETROIT DIESEL PARTS

...factory-engineered for long life, low-cost service



CYLINDER LINER QUALITY CONTROL

In checking the metal's hardness for wear resistance, diameter dimensions are measured electrically as well as mechanically to insure perfect fit and interchangeability. Even the smoothness of the ground liner surface is recorded by this "on-the-production-line" inspection.

MODERN PARTS DEPOTS ALWAYS NEARBY

GM Detroit Diesel Distributors and Dealers from coast to coast carry complete stocks of factory-engineered GM Detroit Diesel parts. They're as near as your telephone—ready "round the clock" to keep your engines working and earning for you.

You're always money ahead
when you buy
factory-engineered parts
from your Distributor or Dealer

GM
GENERAL MOTORS
DIESEL
POWER

DETROIT DIESEL

Engine Division of General Motors
Detroit 28, Michigan

Single Engines . . . 50 to 800 H.P. Multiple Units . . . Up to 893 H.P.

It pays to standardize on GM Diesels

Circle 6 X on reply card

Bethlehem Hollow drills rock at site of Priest Rapids Dam on Columbia River. *General Contractor:* Merritt-Chapman & Scott Corporation, New York; *Consulting Engineers:* Harza Engineering Co., Chicago.

HARNESSING THE COLUMBIA RIVER AT PRIEST RAPIDS, WASHINGTON

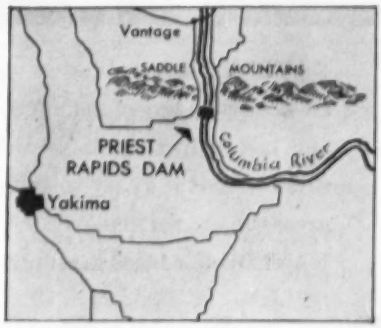
In the picture above, drilling crews are using Bethlehem Hollow Drill Steel in rock removal at the site of Priest Rapids Dam, on the Columbia River, about 24 miles below Vantage, Wash.

The new dam is the first phase of the new Columbia River development, and is being constructed for Grant County Public Utility District. It will be a concrete and earthen structure 8412 ft long, and will have a maximum height of 178 ft. Its eight generators will have a total capacity of 630,000 kw—one of the largest sources of hydroelectric power in the United States.

Bethlehem Hollow Drill Steel is economical in all kinds of rock drilling jobs because it is rolled from fatigue-resistant steel, and has a uniform hole which is centrally located in the bar. Bethlehem Hollow also has a wide quenching range. It is easy steel to heat-treat for the proper balance of toughness and wear-resistance, making possible long-wearing threads and strong shanks.

Bethlehem Hollow is furnished in Carbon and Ultra-Alloy grades in rounds, hexagons and quarter-octagons.

Be sure to specify Bethlehem Hollow for your next rock drilling job.



BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

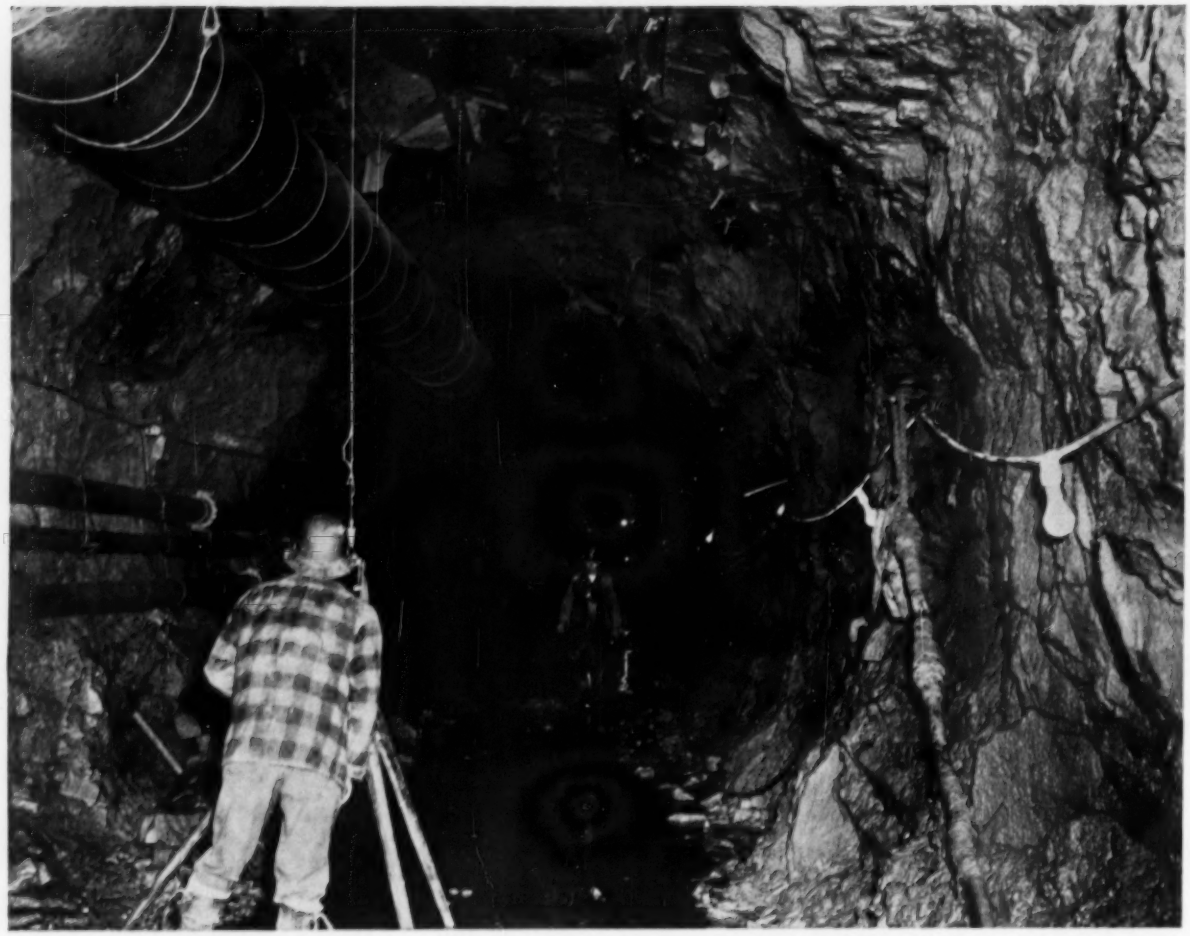
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL

Carbon and Ultra-Alloy

BETHLEHEM STEEL

Makes Your Job Easier
IN TUNNEL CONSTRUCTION



NAYLOR pipe makes it easy to provide fresh air underground. It's easy to handle and install in tunnels because it is light in weight. And it's easy to extend as work progresses . . . particularly with the one-piece NAYLOR Wedgelock coupling to speed connections. Lines hug the wall and can be connected with only one side of the pipe in the open. You'll like the extra strength and safety built into NAYLOR pipe through the exclusive spiral lockseam structure. For details, write for Bulletins Nos. 507 and 514.

NAYLOR

NAYLOR PIPE COMPANY
1945 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office:
60 East 42nd Street, New York 17, N. Y.

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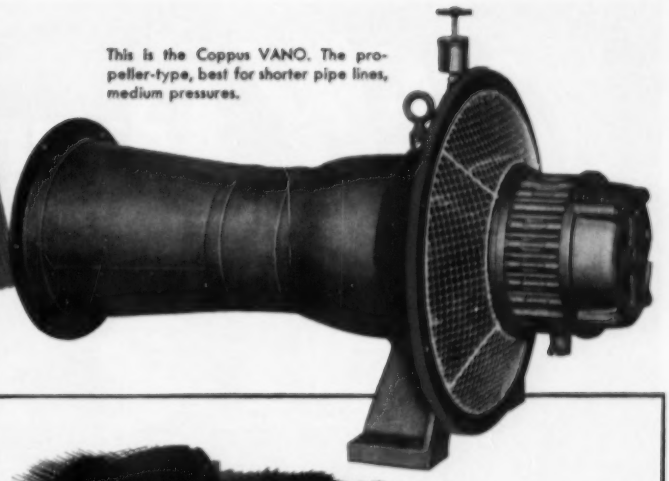
ANOTHER

COPPUS

"BLUE RIBBON" PRODUCT



This is the Coppus VANO. The propeller-type, best for shorter pipe lines, medium pressures.

This is the Coppus VENTAIR. A centrifugal blower, it is designed for long pipe lines, high pressures.

These are the cost-reducing Blowers that give up to 100% more air

Only Coppus makes both types — and both are made especially for *mine* ventilation. One or the other, operating under the conditions for which it is designed, delivers from 30% to 100% more air for a given power consumption than an ordinary all-purpose fan.

They can be used as blowers or exhausters and are driven either by compressed air or electric motor, with capacities up to 90,000 CFM. Like all Coppus products, these blowers wear the "Blue Ribbon" that stands for high achievement in engineering, workmanship and performance.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corp., Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION
210 Park Avenue, Worcester 2, Mass.

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Name .....

Company .....

Address .....

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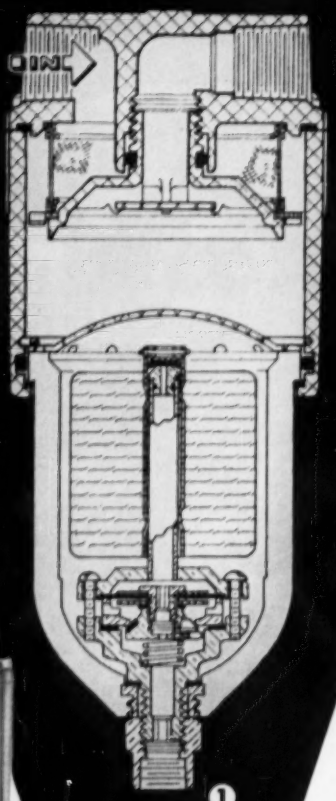
NEW Advanced design Norgren AUTOMATIC-DRAIN AIR LINE FILTERS



1 MORE EFFICIENT WATER REMOVAL

2 WIDER OPERATING RANGE 5 psi to 250 psi, up to 200° F.

BETTER . . .
MORE EFFICIENT FILTRATION OF COMPRESSED AIR

You Get These Important Advantages:

- **More Efficient Water Removal**
  Greatly increased water removal efficiency—even at air flows 143% higher than ever before.
- **Operates Over Wider Pressure Range**
  Top efficiency at as low as 5 psi for all models and as high as 250 psi for metal bowl type.
- **Operates Over Wider Temperature Range**
  New metal bowl models in ¼", ⅜" and ½" sizes extend temperature range to 200° F.
- **Withstand Rougher Usage**
  Metal bowl models are ideal for applications likely to get rough usage.
- **Simplified Drain Mechanism**
  More efficient operation. Fewer parts.
- **Eliminates Manual Draining**
  Collected liquid is drained automatically—cannot return to air line. Drain operates as long as pressure is on the system.
- **Choice of Three Filter Elements**
  74, 64 or 25 micron elements—interchangeable.

NOW—24 Models to choose from

- Transparent Bowls—¼", ⅜", ½", ¾", 1"
- Metal Bowls—¼", ⅜", ½"

Wherever Air is Used in Industry

C. A. NORGREN CO.

3407 SOUTH ELATI STREET • ENGLEWOOD, COLORADO

For complete information, call your nearby Norgren representative listed in your telephone directory—

OR WRITE FACTORY FOR NEW NO. 800 CATALOG

4W

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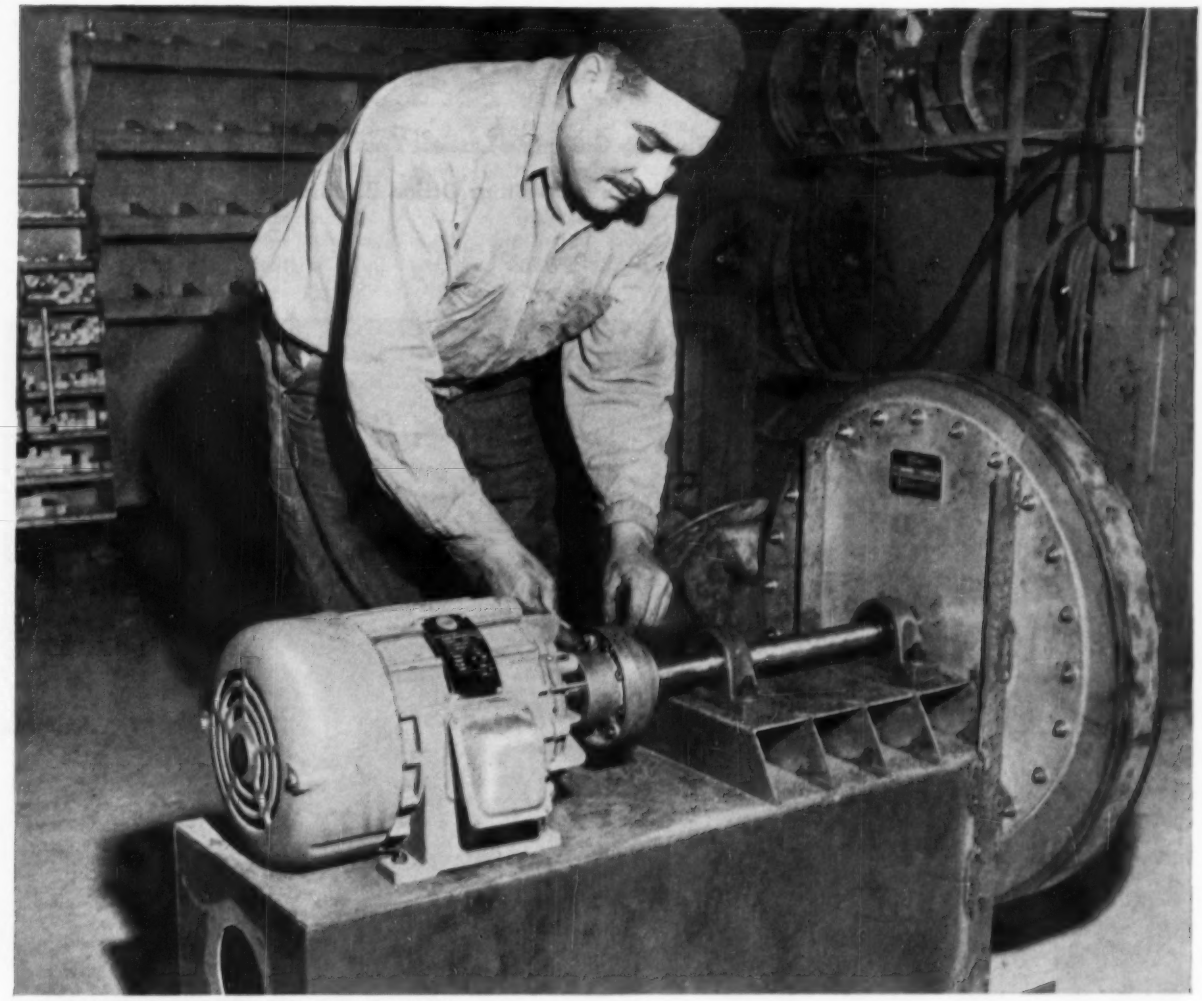

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A BANK IN DOWNTOWN MANHATTAN

Contractors Now Are Sinking Gotham's Largest Foundation for The Chase Manhattan's New 60-Story Office Building

R. J. Nemmers

THE COMPLETED FACILITY

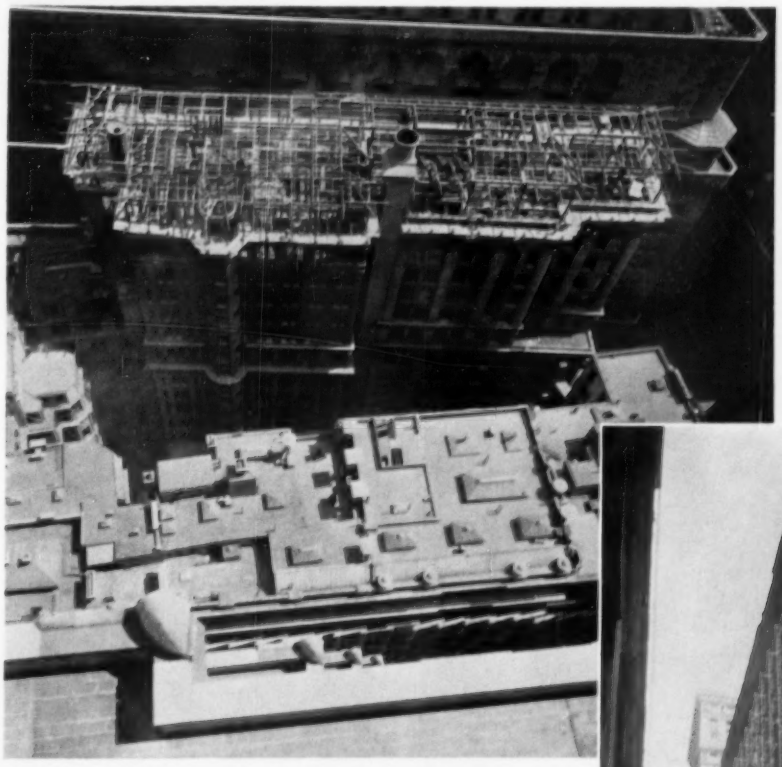
Showing both phases of the Chase Manhattan project as they will appear when it is completed sometime in 1962, these photographs of the architect's model give an impression of the light and air that will be admitted to the once dark, canyon-like street so typical of the Wall Street area. The main banking floor will stretch over most of a 2-block area. The superstructure will be faced either with aluminum or stainless steel.

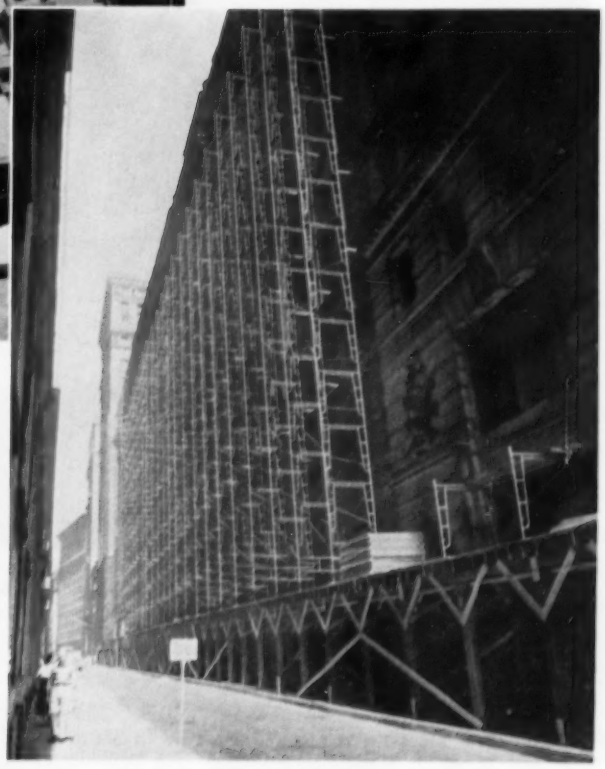
RAPIDLY taking shape in downtown Manhattan, in the heart of the financial district, is a foundation for a mammoth building that will house the head office of the Chase Manhattan Bank, second largest financial institution in the United States. Soaring 60 stories above, and plunging six stories below street level, the building is to be set in a 2½-acre open plaza. The latter, providing a maximum of light and air, is in marked contrast to the prevailing dark canyons of Wall Street. The design of the new structure is proving to be a stimulus to the district and has directly influenced a number of new building plans, not only in the immediate vicinity, but throughout the downtown area.

Of the estimated total cost of $121 million, $94 million will go into actual construction, $17 million into land acquisition and site preparation, and the remaining $10 million is to be spent for furnishings, decorations, etc. The plaza and building cover most of the 2-block site bounded by Nassau, Liberty, William and Pine streets. The building is to rise 810 feet above the plaza and will be 281 feet long and 107 feet wide.

The exterior is to be entirely of glass and metal, dominated by external columns rising from the plaza to the roof on 29-foot centers. Because these columns are on the outside, usable floor space within is increased. The total functioning floor area of the structure will be at least 1,700,000 square feet. If it is decided to carry the floors under the plaza to the same depth as those under the building proper, the total area will be considerably increased. Each floor above ground level will have an area of 30,400 square feet. On the south side of each floor, the design calls for a clear-span area of 287x43 feet; on the north side, a similar area of 287x29 feet. The center section, or core, will be taken up by elevators, stairwells, service lines, lounges, etc.

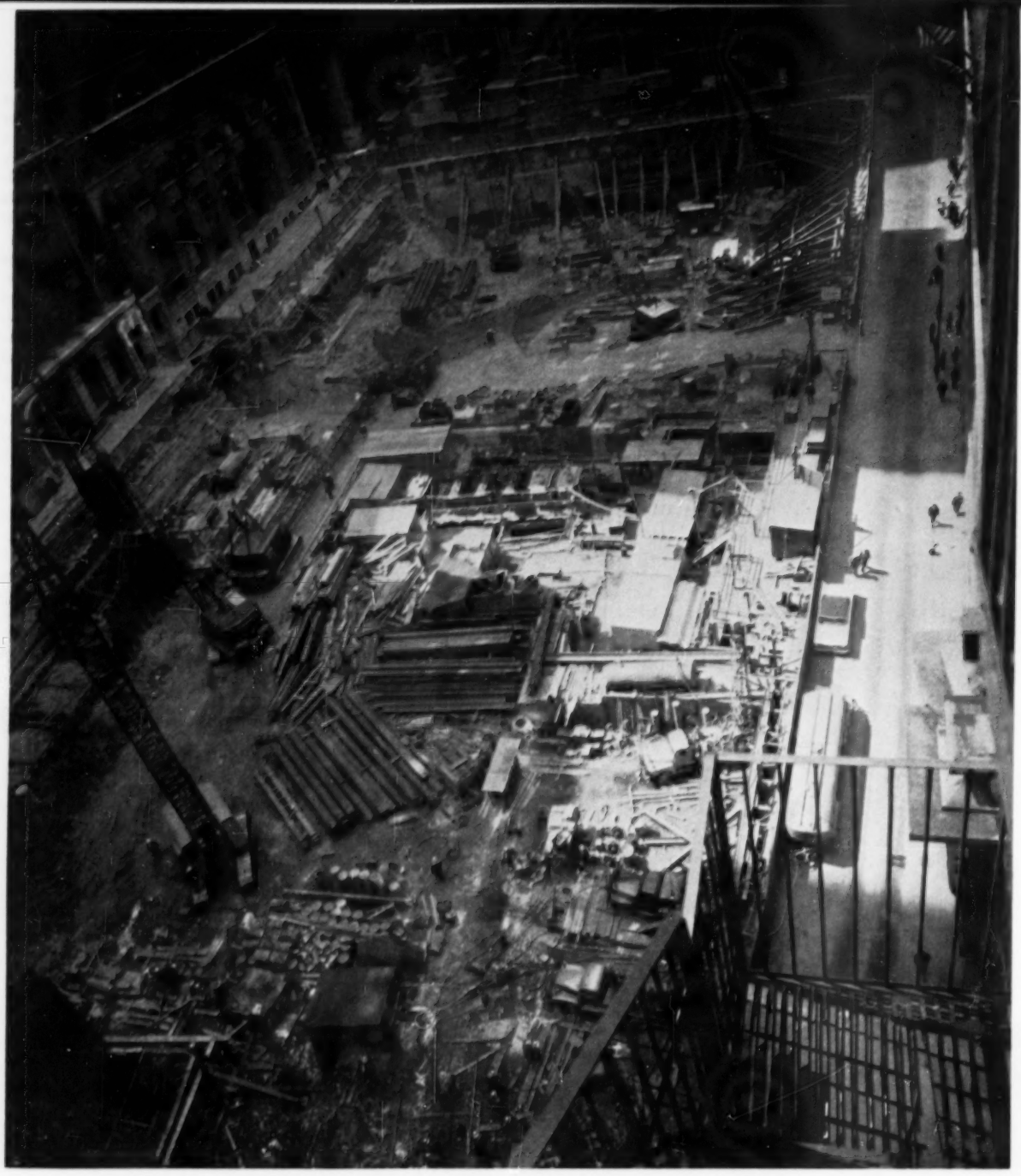
The metallic facing is to be either





DEMOLITION WORK

These two views, taken in the fall of 1955, show demolition work underway on the buildings that stood where the new Chase Manhattan headquarters is now rising. These old structures were founded on steel and cast iron caissons filled with concrete, that are now painstakingly being cut out. One of the structures at one time housed the Mutual Life Insurance Company's head offices.



A WINDOW CLEANER'S VIEW

Shown here is an over-all view of the construction site from the William Street side. At the top is Nassau Street, right, is Liberty and left, is the now closed portion of Cedar Street. This picture was taken in the early stages of work (May 1957), thus there are but six compressors shown, in the center staging area.

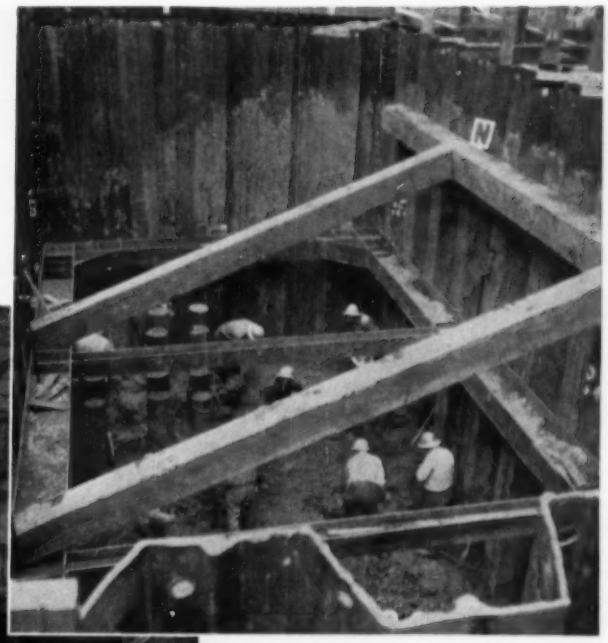
stainless steel or aluminum. At present, an 80x40-foot mock-up is planned, on one face of which aluminum paneling will be placed, and, on the other, stainless steel sheeting. Final decision as to which of the two exteriors will be used will rest on the test structure. The 30-foot height of the mock-up, which will be raised on vacant land in the Bronx Borough section of the city, corresponds to that of the story opening onto the plaza. Other floors above ground are to be 13 feet in height. Of the 60 stories in the superstructure, Chase Manhattan offices will occupy 40, and twenty will be leased to other firms. (Four of the bank's floors are taken up entirely by such mechanical equipment as elevator motors and air conditioners.) The entire building is to be air-conditioned, four 2200-ton units being installed for that purpose.

The main banking floor will be at, and below, street level—beneath the plaza—encompassing the entire plaza and building area. Entrance will be gained from street level on William and Liberty streets and from the plaza level (by escalators) on the Pine-and-Nassau-street frontages. A sunken garden in the plaza will bring daylight to the main banking floor and will have in it a decorative pool.

Some 15,000 people will work in the

SHEET-PILING WORK

In the view below, taken May 6, 1957, and the one at the right taken just a week later, the pattern of excavation for the side walls of the foundation is clearly shown. Two rows of pilings first were driven to the hard-pan strata underlying the area, and then the earth between them was excavated as shown at the left. Also shown in this picture are some of the wooden pilings that supported earlier structures.



building, and another estimated 10,000 will visit it each business day. The largest single elevator and escalator contract ever placed was awarded to Otis Elevator Company to handle the crowds. It comprises 46 elevators, 38 of which will be automatic, main-passenger lifts equipped with the firm's Autotronic regulator that dispatches elevators as required, matching their up-and-down travel according to demand. Ten escalators are included in the order, the majority of which will be located between the main banking floor and the plaza.

The building is to have direct access to three subway lines. A vehicle ramp from Liberty Street will enable cars and trucks to be driven down to basement floors for unloading. Armored cars carrying money and securities thus can be driven directly to the vaults. In the course of construction, one block of Cedar Street will disappear; the Chase Manhattan traded land around the 2-block-site with the City of New York for it on a square-foot-for-square-foot basis. The city will use its newly acquired space for street and sidewalk widening plans; and Cedar Street, although remaining open to pedestrians, will become an integral part of the plaza.

The Chase Manhattan's present headquarters are located at 18 Pine Street. Due to lack of room however, they have spilled over into a number of other buildings in the vicinity. When the new structure is completed, many of the buildings will be razed to make room for the plaza section. Number 18 Pine, along with some other offices owned by the Chase Manhattan will then be sold. Much of the cost of the new bank will be covered by proceeds from the sale of these buildings. Phase 1 of the program, the actual construction of the building, is scheduled for completion by 1960. Phase 2, the plaza, should be completed sometime within the following 2-year period.

A long and complicated survey went into the decision to build the new offices as well as into the most advantageous location for them. Equal study went into the design. Chase Manhattan management, in citing the need for long, clear-span work bays, likens some of the bank's operations to those of production industries. For example, some 2,500,000 checks are processed daily, and there are as many as fifteen operations performed on each. The orders for payment range from less than one, to hundreds of thossands, and even millions, of dollars. In such an operation, the sheer bulk of paper is a deterrent to top efficiency unless working spaces are arranged in accordance with latest ideas in materials handling. The quantity of checks is not actually counted—instead the drafts are weighed in bulk. Through long experience, bankers know how many checks there are in a pound.

Foundation Work

One of the current puns heard around the construction site is that if ever a bank was well founded, it will be the new Chase Manhattan. The "well founded" bank will rest firmly on bedrock, some 85 feet below street level. Embedded in the rock will be the main or maximum security vault. A cafeteria, employee lounges and vast floors—2½ acres in area—for the larger operating departments, will make up the remainder of the underground structure. The current excavation work is going on in the block bounded by William, Nassau, Liberty and Cedar streets. When the hole in the ground is complete, some 223,000 cubic yards of earth and rock, as well as debris from the previous buildings' foundations, will have been removed from the area. (Whether or not this makes the excavation the largest ever dug on Manhattan isn't certain. Veteran construction men on the job think that it is, however. They cite the difference, caused by the terrain, between midtown jobs and those in the downtown area. For example, the Chase Manhattan has to go farther to bedrock than either the Empire State Building

THIS ENTRANCE CLOSED

The new Chase Manhattan structure will have direct underground connections with three subways. During the course of construction, the subway passage, visible through the break in the wall in the picture above, at the corner of Nassau and Cedar streets, was closed off. In the foreground of this view is shown one of three air receivers strategically spotted around the workings.

or structures in Rockefeller Center. There is a prior claim that the foundation of the Federal Reserve Bank across Liberty Street from the Chase building needed the largest hole on the island, and it involved the removal of only 138,000 cubic yards.)

The terrain in downtown Manhattan has presented difficulties other than the fact that the foundation must go down a long way to bedrock. For half its length northward from its lower point, Manhattan Island bedrock slopes down on either side from a central ridge. Above the gneiss bedrock are a layer of hard pan, one of red sand silt and a clay and earth stratum. Sands in the vicinity of Wall Street are water bearing.

One of the original buildings on the site, occupying a lot about halfway between William and Nassau and running from Liberty to Cedar streets was the Mutual Life Insurance building. It was the second structure in the city whose outer walls were founded on pneumatic caissons sunk to bedrock. Because of a unique construction method caissons were not required on the Chase Manhattan job even though ground conditions were extremely tough. The red sand stratum, although it does not permit a free flow of water, is of such a consistency that it flows much like water and must be treated similarly. Its texture can be described only as "liverish," and thus it is known as "bull's liver." In addition there are sand lenses in the hard pan layer that do permit a free flow of water. Pressure determinations in these lenses indicated that a full hydrostatic head of water existed.

The over-all excavation scheme called for the excavation of the plot to an elevation of + 2.5, just above the natural water table. H-beams were driven through the overcast into the bull's liver sand, breast boards thrown up and the walls thus formed heavily shored up to protect the surrounding streets and subway structures. The initial excavation was then done with big shovels.

(Continued on page 296)

BEFORE THE

THE Chase Manhattan Bank was formed by the merger on March 31, 1955, of The Chase National Bank and The Bank of the Manhattan Company, respectively the third and fifteenth largest of American banking institutions. At the time, the new bank had 93 branch offices in New York City, and nineteen others, and four representative's offices abroad. By the end of the year its resources totaled $7,509,247,604. At the present time, it has 99 offices in New York City and nineteen overseas. There are six representatives abroad and one in Washington, D.C. The June 30 financial statement this year showed total resources of $7,524,331,448.

The Manhattan Company

Chartered April 2, 1799, by the New York State Legislature, the Manhattan Company's primary aim was to construct a water supply system for New York City. It was organized to combat yellow fever, a disease mistakenly blamed on the city's unsanitary water. A fatal epidemic had swept Gotham the previous year, and a group of citizens led by the arch political rivals, Alexander Hamilton and Aaron Burr, initiated a project to give the city a pure water system. Twenty miles of wooden mains were laid, supplying 1400 houses. Water was obtained from wells dug near a fresh-water lake known as Collect Pond, and lifted into a large cast iron tank by two 18-hp steam pumps. The Manhattan Company's water system remained the only sizable source of fresh water in the city until the old Croton Aqueduct was put into operation. After that time, the Company's water supply activities diminished in scope. Some evidences of its activities are still being dug up, however—sections of the old wooden mains, made from hollowed logs, have been uncovered in many places in the downtown area, and there is a possibility that additional traces will be revealed as the foundation work for the Chase Manhattan building progresses. Records indicate that one of the old pipes ran along Cedar Street.

The charter for the Manhattan Company was drafted by Burr, and it is under this charter that the present bank now operates. In the original document, Burr inserted a clause permitting the firm to use capital not required by the water works project "in the purchase of public or other stocks, or in any moneyed transactions." It wasn't long until the Company found that a good part of its original capital would not be needed for the water system. On May 15, 1799,

CHASE MANHATTAN

the directors voted to use the surplus funds to open "an office of discount and deposit."

While the Manhattan Company's entrance into the banking business was an immediate success, it added fuel to the fires of the intense political and personal feud between Burr and Hamilton. The latter was the sponsor of the only two other banks then operating in the city—The Bank of New York and the New York Branch of the Bank of the United States. Further, in the elections of 1800, the Manhattan Charter became a political issue in the Federalist campaign against the Jeffersonians, the latter being supported by Burr and his democratic colleagues. Largely due to Burr's excellent political organization—it is said that he was first to make political capital of the widespread Society of St. Tammany, which he managed to switch in political affiliation from the Federalists—Jefferson won the election. Burr however, through some vagary, gleaned as many electoral votes as did Jefferson, thus throwing the election into the House of Representatives. There Burr's supporters fought so ardently—and, it is said, sometimes less than honorably—to see that he was named president in Jefferson's stead, that when the latter finally did become chief executive, he repudiated Burr. In 1802, largely because of the disrepute into which he had fallen during Jefferson's first term, and because of failing personal fortunes, Burr was quietly retired from the board of the Manhattan Company.

Burr served well and faithfully in the role of vice-president, and even his bitterest enemies conceded that his job of presiding over the Senate was capably and honorably discharged. After one term in office, he attempted, in 1804, to gain the governorship of New York State. His bid was bitterly and successfully contested by Hamilton, and the feud finally was settled that same year in what is probably America's most famous duel. Alexander Hamilton was killed on the same field of honor on which his son had perished 3 years previously. In later years, the Bank acquired the pistols used in the grim conflict.

Thus the Manhattan Company was inextricably bound up in the early affairs of the nation. But above and beyond the personal and political activities of those who helped to found it, the bank played an important role in the growth of the country, thereby assuring for itself a thriving existence. For example, the Bank of the Manhattan Company put up a sizeable portion of the money with which the Erie Canal was built. Many of this country's oldest and largest concerns weathered early financial storms with the aid of the bank.

The Chase National Bank

The role of an industrial investor and mortgagee, however, was fulfilled more by another bank founded 78 years after the first "discount and deposit" office of the Manhattan Company had opened. On September 20, 1877, The Chase National opened its offices at 114 Broadway. Named for Salmon Portland Chase, Secretary of the Treasury under President Lincoln, the new bank was started with a capital of $300,000. In contrast, the Bank of the Manhattan had an initial capital of $2,000,000. A New York financier by the name of John Thompson was behind The Chase Bank.

Chase, although he had no direct connection with the bank itself, was worthy of having a great institution named for him. He is credited with starting two major changes in American financial policies during his tenure in the Treasurer's office. The first was the establishment of a national banking system; the other, the issuance of a legal paper currency. The former was Chase's own particular measure; he worked out its details, induced Congress to accept them and administered the system in its formative years. He ended his public career as Chief Justice of the Supreme Court.

Soon after its formation, The Chase Bank became identified with commercial banking. Although the Bank of the Manhattan Company is credited with introducing the correspondent bank relationship (along with check endorsement and credit departments), The Chase National used the idea extensively to foster its own position, becoming the New York correspondent for literally thousands of domestic and foreign banks. When the two banks merged, their combined roster of correspondent relationships became the largest in the country.

The Chase grew without merger until 1921, becoming in the process the second largest national bank in the country. During the following decade, a series of mergers with three other large New York institutions and a number of smaller ones consolidated its position and provided it with a number of branches not only in the city, but overseas as well.

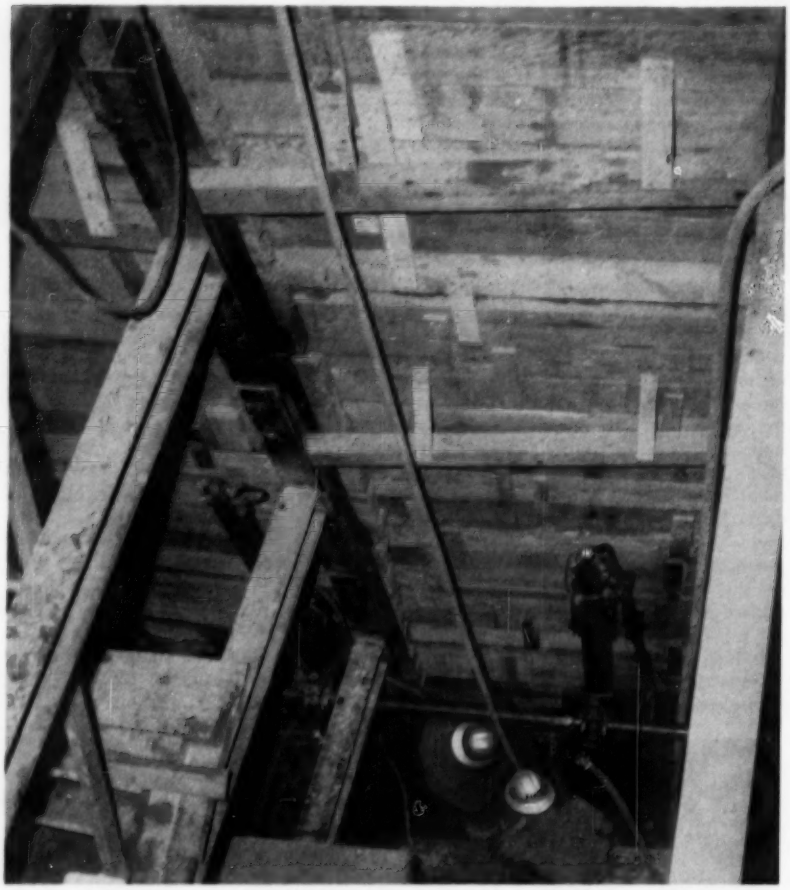
The Chase and the Manhattan weathered the severe financial storms of the depression in the '30s, emerging during and after the Second World War to play an important role in the economic boom of the '40s and early '50s. The merger is said to have resulted in a broader, more comprehensive range of banking facilities, not only for large commercial institutions but, through its many branches, for individuals as well. The provision of well placed branches is almost a requirement for survival in the New York banking field today, largely because of the convenience they offer to small businesses and to individuals throughout the vast city.

UTILITIES RELOCATION

Underlying all of Manhattan Island are the sinews of its existence—the water and gas mains, the electric and telephone cables. In an excavation of the size of the Chase Manhattan's some of these vital arteries have to be be relocated. Doing it without unnecessary disruption is a must. The picture above shows the maze of power lines that had to be safely routed around the site.

DRILLING SETUP

To help increase efficiency in line drilling in the cramped quarters of the footings, the contractors developed the drill rig shown in these illustrations. Essentially it consists of Ingersoll-Rand JHM Wagonjack feed towers suspended from column bar mountings and carrying DB-35 drifters. Holes were spaced on 3-inch centers. Blast holes in the middle area were put down with hand-held machines. The breast boards used in the hardpan stratum are visible in both illustrations.



Then a test pit was put down inside a box formed of steel sheet piling at the corner of Liberty and William streets to see if it was possible to go through the bull's liver without caissons. (Extensive borings had indicated that the lower or William Street end of the site presented the worst ground conditions.) The running sand made open pit work virtually impossible and the test pit was filled in. Next a soil solidification scheme was tried around the test hole. After this was done, the pit was reopened and no difficulty was experienced in penetrating to and through the hardpan stratum. To put the soil solidification scheme to work on the over-all job, a total of approximately 400 holes were drilled on 18-inch centers in two staggered rows along approximate building lines of the lower end of the site. The holes had a cased diameter of 5½ inches to the hard pan, and 2⅞ inches through that layer to bedrock, penetrating the latter about 6 inches. A 1⅞-inch pipe was then put into each hole and the soil solidification chemicals pumped in under 150-psi pressure as the casings were withdrawn. A "2-shot" system was used: first a "shot" of sodium silicate was pumped in, then one of calcium chloride added to jell the mixture. Thus a 2-foot-thick continuous wall of solidified soil was formed around the worst section of ground. Inside this wall two rows of sheet piling were driven. The rows were continued from 13 to 16 feet apart around most of the periphery of the site through the bull's liver sand and to the hard pan layer. (The sections where the pneumatic caissons for the Liberty Mutual building were in place did not, of course, require this treatment because they were founded on bedrock.) The ground between the two rows of piling was then excavated using hand tools and pneumatic clay diggers. As the muck was removed, the sheet-piling walls were braced from within by vertical and transverse I-beams.

When the hard pan layer was reached, it was found necessary to support it in some way as the excavation continued through it to bedrock. Accordingly H-piles were set and breastboards erected as the excavation continued. When bedrock was reached, a system of line drilling and blasting the footings was evolved that greatly speeded operations. Two horizontal, single-screw, column bars bearing on the opposing piling were positioned about 5 feet above the rock and approximately 20 feet apart. Attached to these was a column bar on which were suspended two or three Ingersoll-Rand JHM Wagonjack feed towers equipped with DB-35 drifters. Two of these column bar rigs were in operation. When bedrock is reached in the central part of the excavation, the towers and drills, then mounted on Wagonjacks, will be used to drill blast holes.

Two-inch-diameter holes were drilled in the footings, four holes to the foot; along the face of the piling walls. The depth of the holes varied with the uneven contour of the bedrock surface. On the upper (Nassau Street) end, as much as 21 feet of rock had to be removed. The rock sloped to a thickness of approximately 5 feet at the corner of William and Liberty streets. After line drilling, blast holes were sunk with hand-held machines in the center of the footing area and lightly loaded, covered with blasting mats and fired. Broken rock was mucked by hand into small buckets and hoisted by cranes to the surface where it was trucked away.

After a 20-foot section had been drilled and mucked, forms and reinforcing steel were placed and the concrete poured for that section. The initial concreting was

carried to an elevation of +2.5—some 20 to 30 feet below street level. The work has proceeded with the pouring of alternate sections. Edges of these are keyed and rubber seals have been cast into the locks. Reinforcing bars also protrude along the mating edges so that fill-in sections can be firmly tied in. The transverse I-beams as well as the outer sheet piling are left in place when the concrete is poured. The inner row of piles will be removed as the area within the side walls is excavated.

The latter job is also presenting its problems to the contractors. As we mentioned, the previous buildings on the site were founded on concrete-filled caissons or on wooden or cast iron pilings and all of these, of course, must be removed. Water is not expected to give any difficulties. The prior construction of the sidewalls will have formed, in effect, a sealed basin into which no water can flow and from which trapped water can easily be pumped.

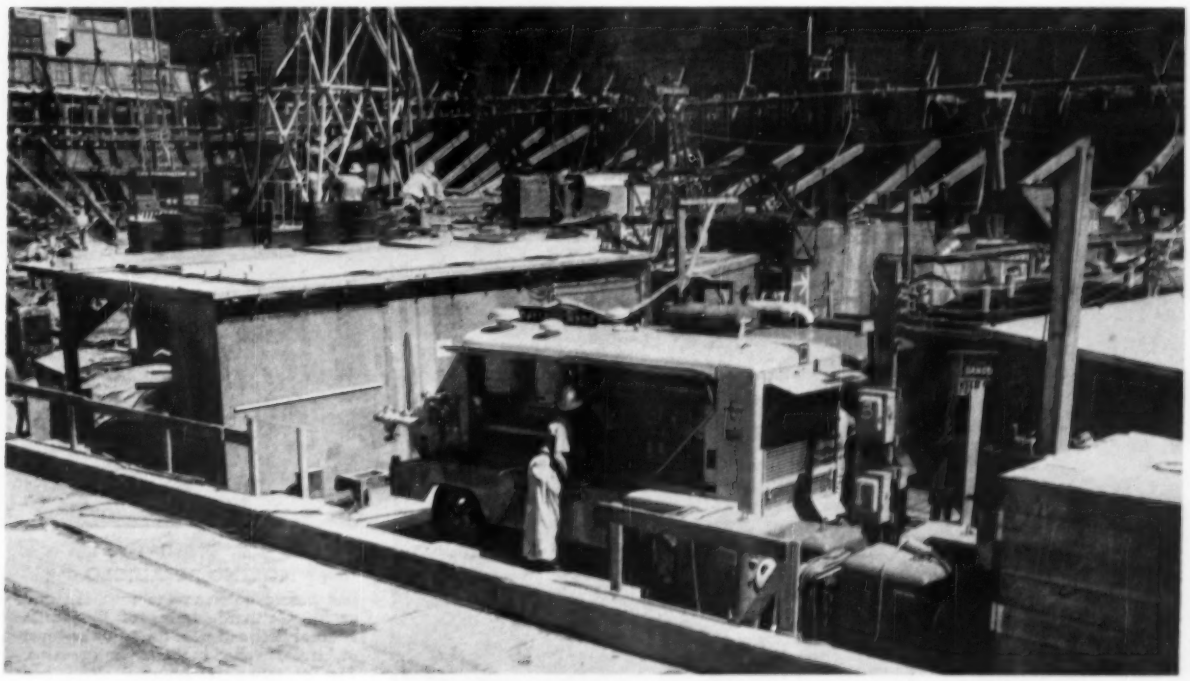
As soon as the sidewalls are prepared and the major portion of the old catacomb-like basements of previous structures is removed, the heavy equipment in the workings will be taken out. Three ramps founded on pilings are being built out over the excavation from Liberty Street. Only lightweight equipment will then work in the hole, mucking spoil into large buckets. Cranes stationed on the ramps will then raise the buckets dumping them into trucks for disposal.

As the level of spoil in the excavation goes down, three sets of cross beams running the length and width of the basement will be installed. To be the main members in the subfloors, they will support the outer walls. As they are installed, each beam will be prestressed by means of four large 300-ton-capacity hydraulic jacks. In the process the beams will be shortened about 1.6 inches by pressures of 18,000 to 20,000 psi. This precompression will take up the lateral loads on the outer walls, thus preventing cracking or collapse as the internal supports are removed. The contractors now are training the personnel for this job by a test setup in the excavation. The short test beams are positioned between old caisson walls, and efficient methods are being worked out for the placement of the full size cross beams. The plan calls for completion of the substructure by September 1, 1958, and work is being carried on 6 days a week, three shifts per day.

The air plant for the present workings consists of eight portable compressors. Three are of 500-cfm capacity and are reciprocating units while five are Gyro-Flo (rotary) machines. Of the latter, one is rated at 900 cfm and the remainder, 600 cfm. The rotary units handle the base load, the reciprocating units being used as standbys. The compressors discharge into a common header from which air is piped to three large receivers spotted around the workings. The compressor plant is out-of-doors and now is located at the William Street end of the excavation.

Change shacks for the working force have been erected on scaffolding over Cedar Street. The field office is immediately next to the workings, at Number 61 William Street. Another job office, opening off Liberty Street, overhangs the excavation. Access to the job site is by means of a ramp leading down from the corner of Liberty and William streets.

Skidmore, Owings and Merrill is the architectural and engineering firm handling the erection of the new building. Moran, Proctor, Mueser & Rutledge is handling engineering of the foundation. The foundation contractors on a joint venture and working under a cost-plus-fixed-fee contract are The Foundation Company (sponsor and contract manager), George M. Brewster & Son, and the Joseph Miele Construction Company, Inc. Louis Miller is the project manager, Eugene Fullam, W. O'Mara and W. Brunoff, general shift superintendents and Edward Hagerty is the master mechanic. Andrew Fisher oversees the job for the Chase Manhattan Bank.



AIR SUPPLY

At the peak of drilling and paving breaker activities, a total of 4800 cfm of compressed air has been available. The plant is made up of eight portable compressors of which three were 500-cfm reciprocating machines largely used as standbys, and five were Ingersoll-Rand rotary Gyro-Flo units. Of the latter, one was a 900-cfm and four were 600-cfm units. All discharge to a common header from whence air is conveyed to several large receivers spotted strategically around the work site. The machine shown in the picture above is the 900-cfm unit. Behind it is the carpentry shop where lumber for the footing forms was sized.

From Airolo To Göschenen

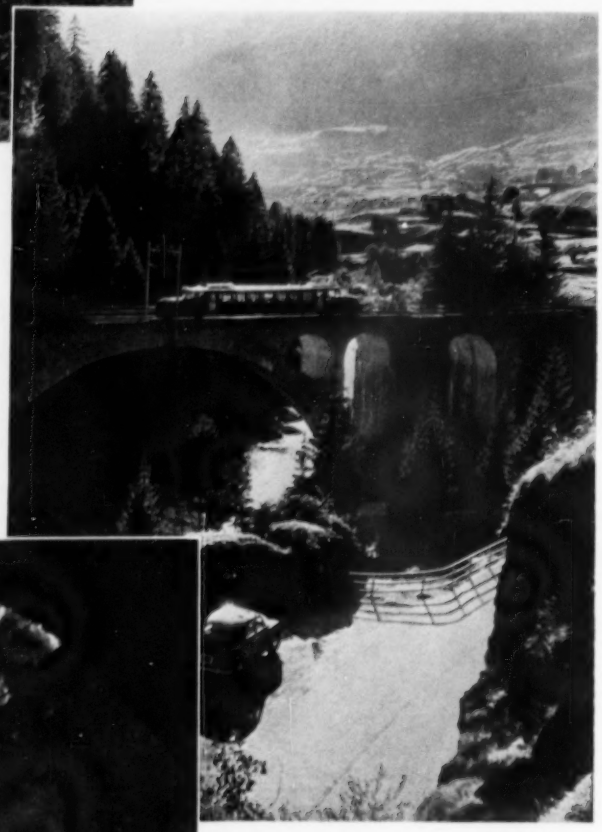
Second passage under the Alps, The St. Gotthard Tunnel was built With compressed air and Pneumatic tools

S. M. Parkhill

RAILROAD YARDS AT BELLINZONA

In the southern tip of Switzerland lies the town of Bellinzona, 105 miles from Lucerne. It has long played an important role in European history because of its strategic proximity to several Alpine passes. Above can be seen the massed rail lines of the St. Gotthard Railway.

PHOTOS, SWISS NATIONAL TOURIST OFFICE

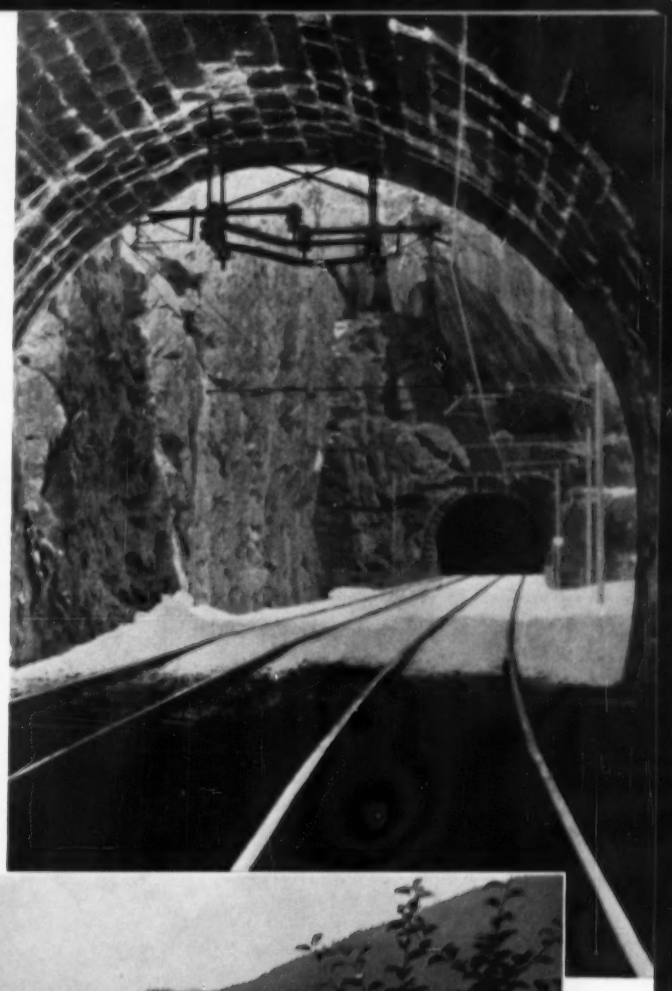


INTO THE TUNNEL

One of the Swiss Federal Railroad electric trains is shown (below) entering the St. Gotthard Tunnel. In the background rises one of the peaks of the Lepontine Alps, and overhead can be seen the power lines for the locomotive. The line was electrified in 1924 for reasons of efficiency and better ventilation.

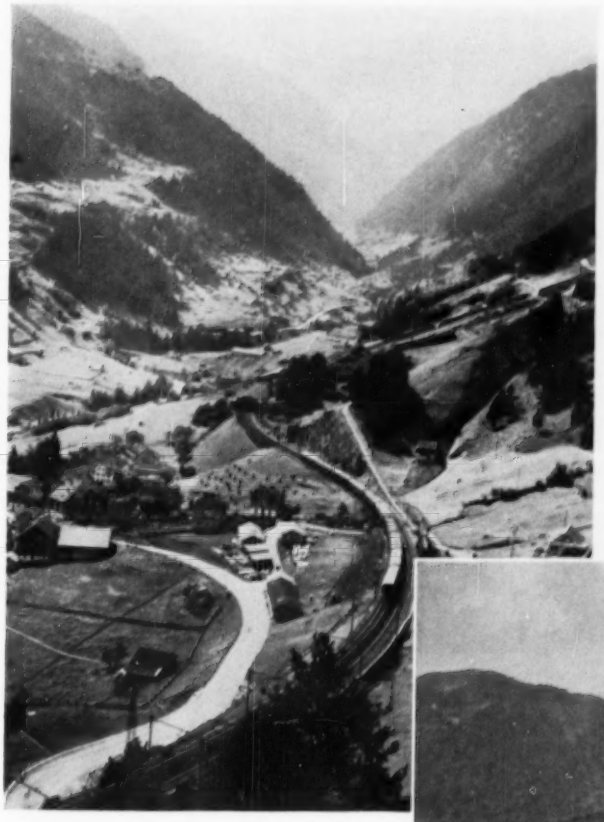
MOVING BY AIROLO

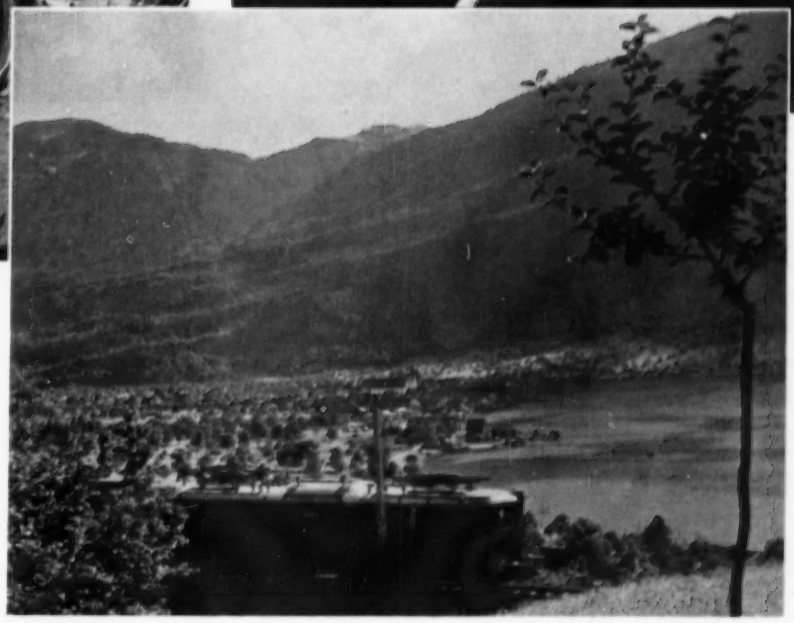
Just before entering the southern end of St. Gotthard, trains of the Swiss Federal Railroad pass through the town of Airolo, nestled in the Lepontine Alps. The entrance is situated 3756 feet above sea level, and because of the rugged terrain and steep incline, trestles and spiral loop tunnels had to be constructed before the passage could be used.



TUNNEL APPROACHES

Looking between two spiral loop tunnels on the St. Gotthard line. To help lessen the climb at the entrances of the tunnels, three of these bores were made at the northern end; and four, at the southern terminal. On the approaches, there are a total of thirty tunnels, four of which were originally constructed for double track. Most had to be widened so that trains could pass. It was accomplished entirely by blasting.





ON TO THE NORTH

Emerging from one of three of the spiral tunnels, at Wassen, north of Göschenen, an electric-driven train (above) proceeds towards Lake Lucerne. Over these tracks, 170 trains pass daily. At the left of the train can be seen a little village in the Canton of Uri, native land of the legendary William Tell. Nearing the end of a journey (right), a train nears Arth, at the southern-most tip of the Lake of Zug in the Canton of Schwyz.

PHOTOS, SWISS NATIONAL TOURIST OFFICE

ONE of the great pioneer tunnels in the world celebrated its seventy-fifth anniversary this year. The St. Gotthard Tunnel, as it is called, is a 9.3-mile passage under the Lepontine Alps between Airolo at the southern terminal, and Göschenen on the north. Although originally constructed to pass about 30 trains daily on the route between Lake Lugano in Italy to Lake Lucerne, Switzerland, improved central signal devices have increased its capacity to 170 trains in every 24-hour period. In 1956, more than 100,000 motor cars and trucks were transported through it.

The next tunnel under the Alps, for motor vehicles only, will be at Mont Blanc. Men working there, in better ventilation than at St. Gotthard and with improvements in compressed-air working, rock drills and mucking equipment, will undoubtedly salute their predecessors who used what could be termed "crude" equipment to accomplish their ends.

The first attempt to drive a bore under the Alps was made in 1450. It was to run under the Col di Tende, a 6158-foot pass in the Maritime district, on the road between Nice and Genoa. Plans were made and tunneling began, but the project was abandoned. Victor Amadeus III reactivated the scheme in 1782, and

construction continued for another 12 years before it again stopped. Later, after Napoleon Bonaparte built a carriage roadway over the pass, the original plans were permanently put aside.

The first successful tunnel in the same general region was that at Mount Cenis. It was to be 8 miles long, four times the length of England's Box Tunnel (completed in 1841), which was the longest then in existence. Many doubted the possibility of such an engineering feat, but nevertheless, the Italian government began work in 1857. Hand methods were used, and engineers anticipated a 50-year job. Realizing the expenses involved in such a long-term project, Germain Sommeiller, the French engineer in charge, undertook the development of an air-powered drill. The first of his experimental machines was put to work in 1861. With the new equipment, headings proceeded ten-times faster than they had previously.

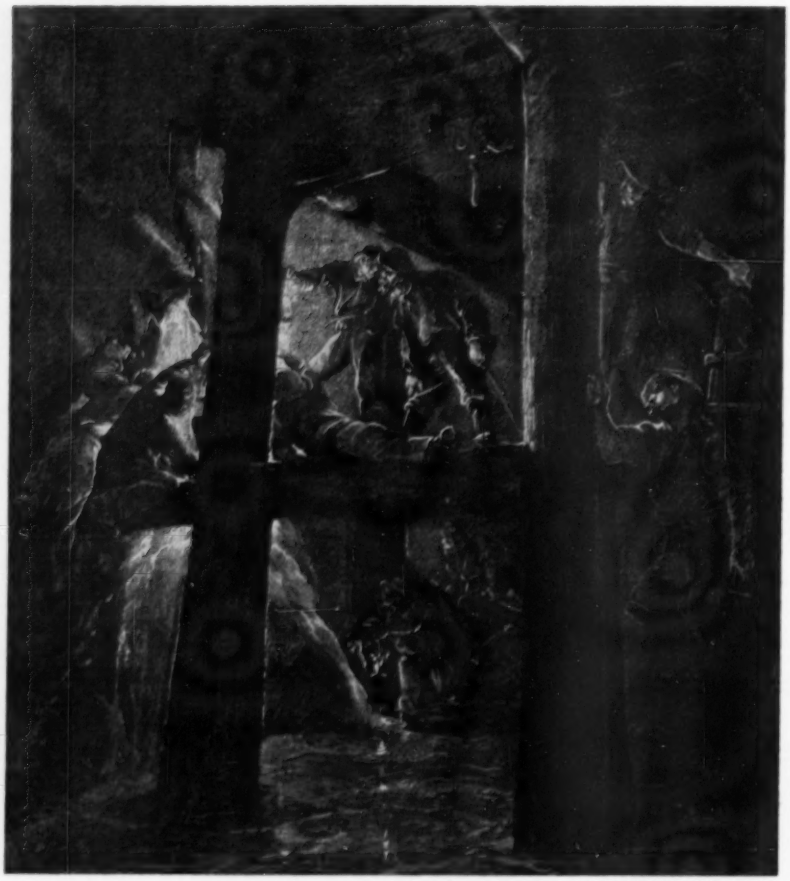
With the opening of the pass on September 17, 1871, economical and commercial changes in nearby countries were better than had been anticipated, so a second tunnel was planned further north. The St. Gotthard Pass, which it was to follow, had been serving Italy and Switzerland since the sixth century, at first, as nothing more than a 13-foot wide pack-animal path, and later (1820-1824), as an 18-foot-wide carriage road.

The proposed bore, to serve rail traffic, was to be 26 feet wide, 24½ feet high and about 9 miles long. Under a joint treaty between Germany, France and Italy, the contract was let on May 7, 1872, to M. L. Favre of Genoa, who gave a $1,600,000 bond for the successful completion of the work by 1880. Construction began at the southern extremity on September 12, and at the northern end on October 24, 1872.

Trouble began almost immediately. Crevices in the rocks acted as a pipe system, and water jetted out in considerable quantities and at great pressures. On the southern side, at Airolo, the drill holes poured out so much water that it was difficult to keep dynamite in them for firing.

Rock dust, oil lamp fumes, exhalations from men and horses, explosive fumes and 80°-95°F temperatures caused workers to become too sick to carry on after about 3 to 4 months. If they did, reports indicated that they became invalids for life, if they survived at all. About 200 men were lost during the entire project; less than half died from accidents. At any one time, only 40 percent of the working force was on the job. Editorial comment of the day referred to the project as "one of the most expensive undertakings of the age."

Still further difficulties resulted from the material penetrated. For the most part, the 48,887-foot length was driven through various kinds of schist, interspersed with gneiss, mica-schist, serpentine and hornblend. The rock was fissured badly and shattered easily. In addition, chalk veins proved troublesome in that they decomposed rapidly when air contacted them. Quite frequently they surrounded pot holes full of loose gravel. When unduly charged with water, the chalk broke away, releasing the rubble.



BETTMANN ARCHIVE PRINT

NATURE'S WATER MAINS

One of the greatest problems in tunneling was that of water. Crevasses in the rocks acted as water pipes and frequently flooded the working areas, as illustrated here by a nineteenth century engraving. Near Airolo, the men had difficulty keeping sticks of dynamite in the holes for blasting because the water gushed forth with such quantity and force.

Perforators

The first rock drills, or perforators, used in the advanced galleries at St. Gotthard were manufactured by Dubois and Francois. They had four successive movements: *delivery* of quick, rapid blows on the rock by a jumper; *turning* of the jumper on its axis after each blow to increase the effectiveness of the next strike and to prevent the drill from becoming lodged in the rock; *advancement* of the drill at the will of the miner so that he could regulate the length of the stroke and follow up the hole; and *withdrawal* of the machine promptly when the tool or machine had to be changed. These perforators delivered 250 to 500 blows per minute.

The octagonal, solid-steel boring bars were keyed to the piston rod of the machine. They varied in length from 4 to 6 feet, depending on the ground and stone being worked. Each had a 1-inch diameter and a simple forged chisel edge.

Six drills were fitted to a 4-wheel carriage, the frame of which was of cast and wrought iron, bolted and riveted together. Each unit had a 10-foot length and stood about 4 feet high. It moved on tracks, and when drilling was being done, was blocked up on fir battens.

Ferroux designed another type of drill that was common in the workings. It was similar to the Dubois-Francois models, but as an additional feature, contained an automatic movement by which the percussion cylinder followed up the hole spontaneously.

Still a third variety of perforator used was made by McKean. The body of the 7½-foot, 506-pound unit was of cast phosphor-bronze, its air cylinder had a 4-inch diameter, and the wrought-iron

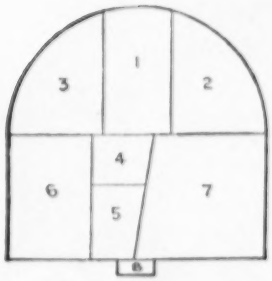
piston was 2 inches thick. The McKean machine could bore to a depth of 3 feet before it had to be repositioned and could deliver a maximum stroke of 5 inches. During comparative trials, it delivered nearly 700 strokes per minute, using air at about 95-psi pressure, and penetrated as much as 12 inches every minute in soft rock.

Like the Dubois-Francois perforators, the McKean could be mounted on a drill carriage, or *affut*. The frame of the rig was constructed to mount four drills. As an aid to positioning the drills, the back of the rig was built on a 3-inch horizontal pivot. Mounted thus, the frame could be raised or lowered by means of a vertical screw. At the rear was a 10-inch-diameter cylindrical distributor for compressed air. It was made of 4-foot-long, ⅜-inch iron plate, welded at the seam. One-inch rubber air hoses were attached between the distributor and each tool.

Heavy, bulky and slow, requiring vast crews to operate, the drills at St. Gotthard cannot be compared to modern high-speed equipment. The old machines were practicable only because of the size of the tunnel being driven. It remained for Simon Ingersoll and Henry C. Sergeant to develop lightweight drilling machines that could be used with ease by small crews and single workers. For all practical purposes, really efficient tunnel driving had to wait even longer—until Leyner's development of a water injection drill and hollow steel.

In driving the headings, the center top section was first removed, followed by the areas to its right and left respectively. The center of the next layer was then withdrawn, followed by the material at its sides. Finally, a narrower, lower portion was taken. The first section of the heading was never driven less than 1000 feet in advance of the second and at times exceeded the latter portion by more than 3000 feet. The top opening varied in size from 8¼x8½ feet to 8½x9 feet, depending on the quality of the rock in the area.

Drilling was done by a circular cut method. Three holes comprising a burn cut were driven near the center of the heading. Around these, nine to thirteen more were driven parallel to the tunnel axis. The center ones were blasted first, and were followed by the surrounding holes. Three to 5 hours were required to drill the two sets, and from 3 to 4 hours for removing the dislodged rock. Thirty-six to 40 holes were required to remove the entire section.



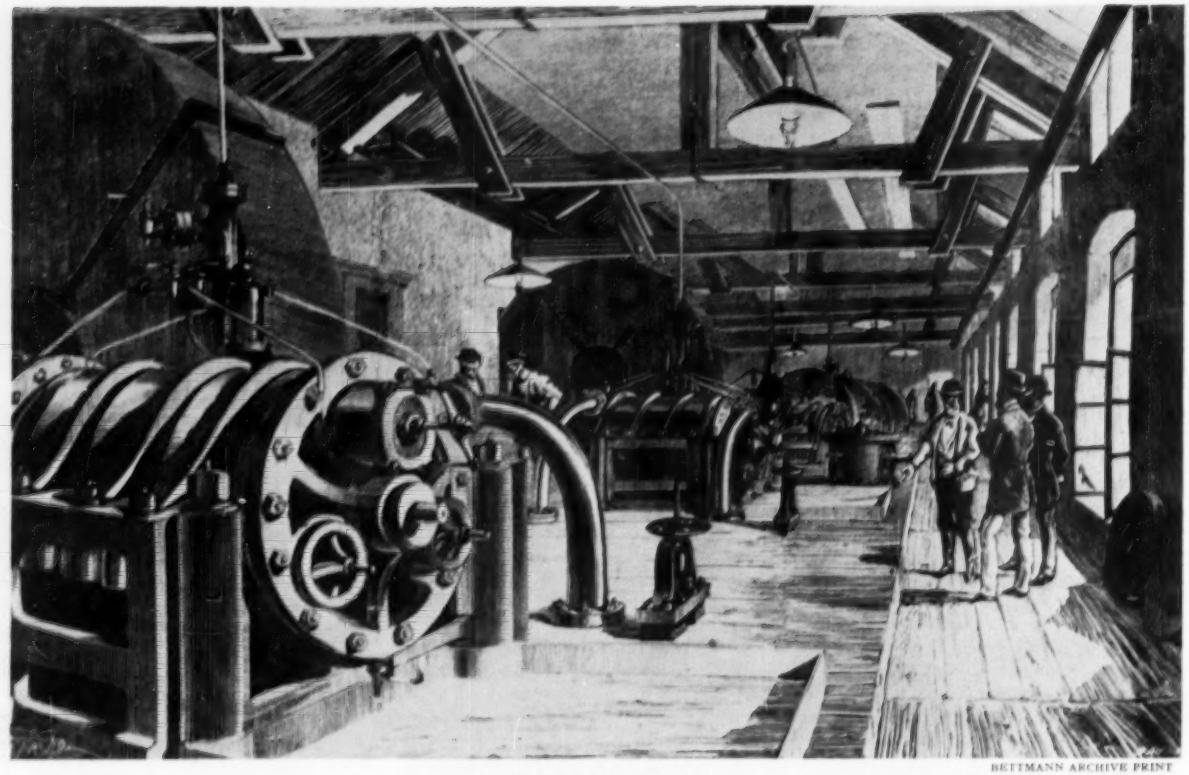
EXCAVATION SEQUENCE

Above is a diagram illustrating the method of tunneling during the construction of St. Gotthard. The procedure was typical in nineteenth century Europe. The center of the top heading was driven first, and then widened by removing parts 2 and 3. An arch roof was then built, with its base resting on the unexcavated portion of the bore. The lower portion was then removed, first by sinking a trench (4), and then by removing part 5. When widened, the side walls were thrown up. The culvert, part 8, was the last to be withdrawn. As a general rule, the heading was driven far in advance, but the excavation of each of the other parts followed the preceding one at a distance of about 300 feet.

BETTMANN ARCHIVE PRINT

ENTRANCE AT GÖSCHENEN

The engraving above depicts a shift of workers riding into the northern entrance to St. Gotthard. Three shifts of 38 men each were employed. Each consisted of a foreman, four miners, two machinists, eight laborers and one "boy," at the front, and 22 additional men to work as chargers and laborers for removing the rock.



BETTMANN ARCHIVE PRINT

COMPRESSOR STATION

The print above shows the compressor station at Airolo as it looked in 1880. Water power from the Tessin and Tremola rivers drove horizontal turbines that were connected to the compressors. By arranging four turbines and five groups of compressors together, a large volume of air could be compressed to about 88 or 100 psi.

Narrow-gauge tracks, descending to the tunnel entrance, were laid on the floor of the heading, and horse-drawn cars were used to carry away the debris from the first two sections. When they reached the finished portion of the workings, the material was dumped into larger, broad-gauged cars, hauled by compressed-air locomotives. Three engines were used at each end. Hoisting devices raised incoming construction material from the larger- to the narrower-gauged cars above.

Compressors at Airolo

Originally steam air-compressors, based on the same principle as the famed Sommeiller pumps developed at Mount Cenis, were used. A heavy flywheel arrangement made up one end; and a pair of direct-action horizontal steam pumps, the other. Each unit was laid on a single base plate, and the piston rod of the cylinder worked the air pump. These steam units were of a temporary nature and were placed in reserve in November 1873.

Since there was plenty of potential water power at the tunnel terminals, it was decided to utilize it for working the air compressing pumps. Two sources were available at the south, the Tessin and Tremola rivers. The former did not offer enough of a fall, and the latter could not be depended upon to furnish a steady flow. It was therefore necessary to construct an artifical drop of 531 feet. With water falling so rapidly against the turbines, there was excessive wearing of the cast iron and steel parts; they had to be replaced every 4 months.

The turbines were of a horizontal variety on vertical shafts. The crown of each was made of bronze, cast in one 100-blade piece. It had an exterior diameter of about 10 feet and a thickness of approximately 11 inches. When sufficient water passed over it, the wheel turned at 390 rpm, and the velocity at the circumference was 80 fps. The shaft in each was fitted with a bevel pinion on its upper end, and that was geared into a large bevel wheel fixed on a horizontal shaft. This in turn was formed to three throws, or cranks, which were coupled to the three compressors. The turbines were placed in line and the horizontal shafts of each were coupled together, end to end, to form one continuous piece. Thus the work done by the three was equalized and distributed uniformly over all the groups of compressors.

The cranks of each group of compressors were connected at equal angles around the shaft. Resistance was thus practically uniform, even when the velocity of the turbines was reduced by half. Thus, a heavy flywheel was eliminated. The compressors in each group were fixed horizontally on one frameplate. The cylinders were about 18 inches in diameter and had a stroke of approximately 17¾ inches.

The force of all the turbines could be concentrated on three groups of compressors to gain approximately 118 psi. Four turbines and five groups of compressors could be connected and operated together according to the quantity of water available. In this arrangement a large volume of air could be compressed to about 88 or 100 psi.

Two methods of cooling the compressed air within the pumps were used. Every part that was in contact with the air when undergoing compression was cooled by currents of cold water passed through airtight envelopes. The piston rod was made in tubular form, and cold water was injected and circulated through its interior. In the second method, cold water in an extremely divided state was injected from two ends of the cylinder. Water had to be double-filtered for this application to completely separate the fine granitic sand that was brought down from the Alps by the torrent, but it made the cooling more effective than if it had not been used. The water injected was generally less than one-thousandth part of the volume of the air drawn. It was carried with the compressed air into receivers, and there separated.

Four wrought-iron air reservoirs, with

hemispherical ends, about 5½ feet in diameter and 29½ feet long, were placed end to end. Each had a capacity of 593 cubic feet. Water and air passed from the compressors through a central pipe into the first reservoir where they were separated. With the water removed, the air passed through each of the succeeding ones to the distribution mains.

Compressors at Göschenen

In the north, the Reuss River had a 305-foot fall. A reservoir was constructed at a place about 870 yards beyond the turbines; the hydraulic force obtained was nearly double that at Airolo.

A main water supply pipe was made of 20-foot lengths of riveted sheet iron tied together with rubber-joint flanges. This branched into two smaller cast-iron tubes, each section of which was 2.03 feet in diameter and nearly 10 feet long. From these, water was supplied to the turbines.

At Göschenen, as at Airolo, there were three groups of compressors. Near each set of three was a Girard "wheel" turbine with a horizontal shaft. Power was transmitted to the compressor shaft by means of two pairs of spur wheels in the ratio of 1 to 2, one pair fixed on each. The turbines had a regular speed of 160 rpm and were rated at about 250 hp each. They were equipped with 80 buckets and had an external diameter of 7 feet 10½ inches.

In the compressors (rated at 141 cfm at approximately 104-psi pressure), the pistons and rods were hollow and cooled by water circulated within them. However, unlike the pumps at Airolo, water was also introduced outside the piston to cool the cylinder itself. The 7-inch-long pistons had two gun-metal rings, one near each face. The space between the rings was turned down and received a thin layer of water. Since the fluid was maintained at a pressure greater than that of the piston, it formed a tight seal.

The compressed air was drawn from the receivers by an 8-inch-diameter tube. This diminished in size to 4 inches, and near the drills, to 2.4 inches. The effective pressure near the receiver was 88-102 psi, and at the working face, 51-59 psi. Higher working pressures awaited the development of both multi-stage compressors and better rock drills and drill steels.

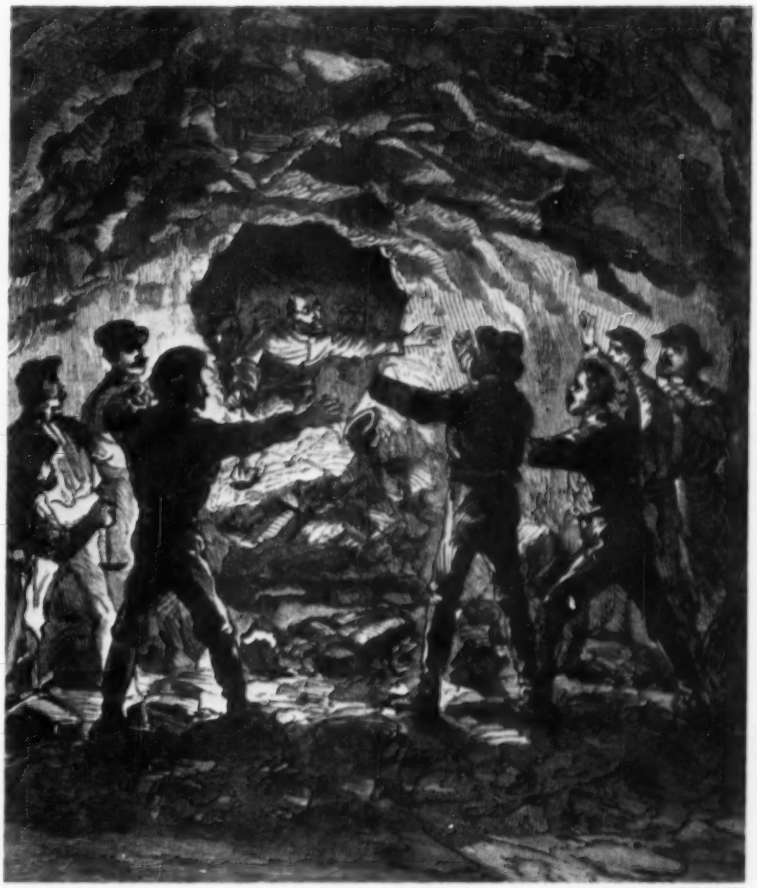
Tunneling Through

On February 29, 1880, the headings met, and an opening was cleared so that a man could crawl through. The tunnel was not completed, however, until June 1, 1882. The cost of the project was $231 per lineal foot, or a total of $11,300,000. In spite of the fact that the tunnel was longer than the one at Mount Cenis, the cost was less than four-fifths of the latter. The reduction is probably due to a greater progress rate that resulted, first, from the system of excavation as opposed to the bottom-heading practice used at Mount Cenis. In addition, there was a better utilization of the hydraulic power at St. Gotthard than at the earlier structure. In the third place, high-speed air compressors with finely divided water kept the equipment at moderate temperatures for the day. Rock drills and drill carriages were vastly improved. As a fifth reason, dynamite was used instead of the compressed powder at Mount Cenis; and as a final factor, compressed-air locomotives, operating at approximately 190-psi pressure, were utilized.

Even with the reduced costs, the contractor lost $1,400,000, and he worried so much about the structure that he never saw it finished.

The St. Gotthard Tunnel is lined throughout; the arch and culvert are of brick, and the side walls, of rubble masonry. Three-foot shelter niches are provided; and at every 3000-foot interval, there is a 10-foot-deep storage space.

To avoid excessive climbs to each end of the tunnel—the northern being 3638 feet above sea level; and the southern, 3756 feet—spiral loop tunnels were cut from the solid rock mountains. These approaches are more accurately described as helical; however, the misnommer has remained with tunneling men through the years. Three are located before the Göschenen terminal, and four are at the Airolo entrance. One of the tunnels rises 311 feet, making a three-quarter circle. Even with these approach modifications, it was necessary for railroad engineers to get up a good head of steam before trying the approaches. As a result, the Swiss Federal Railroad electrified St. Gotthard in 1924, and it remains today, as it did when it was constructed, with this one exception.



BETTMANN ARCHIVE PRINT

TUNNELING THROUGH

Early in 1880, in anticipation of the approaching junction of the headings, telegraphic communication was established between the two working shifts. The chief miner on the southern side probed forward with a 10-foot-long jumper rod from time to time until on a Saturday evening, February 28, the rod broke into empty space. The following day, a hole 5 feet in diameter was blown, leaving a funnel-shaped passage for men to crawl through. It was not until December of the next year that a locomotive passed through the tunnel for the first time, and not until January 1, 1882, that the line was provisionally opened.

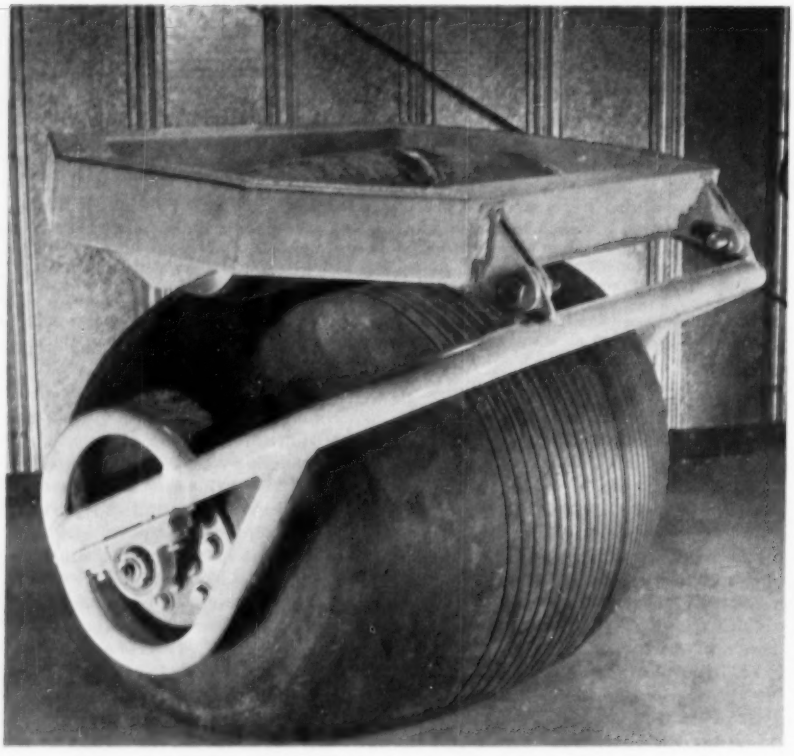
Albee Rolligon Wheel-Less Truck

A TWENTIETH CENTURY ARK

Peter Sleight

LIKE the Ark of Biblical days that floated its passengers through the deluge, a huge, wheel-less Rolligon "floats" its payload overland on soft pools of air confined in sausage-shaped pneumatic bags. Built specifically to operate off-the-road, the 6x6 vehicle is powered by a 185-hp Chrysler V-8 engine. It is able to carry a 7-ton load cross-country, no matter whether the terrain is smooth or consists of rocks, swamp, brush, snow or light timber deadfall. Even more important, the unit is reportedly as inexpensive to operate as a truck rolling along a smooth highway. The manufacturer states that the vehicle can travel at speeds as great as 41 mph. For aquatic travel, propulsion is derived from the whirl of the bags. In the event that greater water speed is required, provisions have been made for a propeller and shaft.

Builders of the Arc, as it has been dubbed by the Albee Rolligon Company of Monterey, Calif., expect it to be useful in opening up and providing economical transportation through vast wilderness areas in many parts of the world where highways are impractical, if not impossible. It is anticipated that it will have many other uses as well, such as low-cost off-road operation in such localized activities as logging, mining and oilfield development. The Arc is even practical for "backyard" jobs like hauling building materials into muddy construction sites. An initial production run is scheduled to begin late this year.



TOP-LOADING vs AXLE-LOADING

Rolligon's method of transportation differs from the conventional-wheeled vehicle's by carrying its load entirely upon the top surfaces of its low-pressure air bags. Instead of on an axle, it is placed upon a small, solid-load roller that revolves against the rubber bag's topside. Both motive and braking power are applied to the rubber air bag through the roller by friction contact. Much heavier weights may be carried for each pound of air pressure by this top-loading method than by axle-loading. Stresses and flexures of many kinds inherent in axle-loaded-and-driven tire devices are said to be virtually eliminated with this method. Balanced tension is exerted throughout all the walls of the bag simultaneously.

Developed by William H. Albee, the vehicle's large size and capacity belie how seemingly lightweight and gentle it really is. Pressure exerted on the ground, when the truck is empty, is about 2 to 3 psi—not enough to harm a man lying in its path. A comparable highway truck with standard wheels has a ground pressure of approximately 70 psi. When the Arc is fully loaded, the pressure exerted on the ground is increased to only 5 psi.

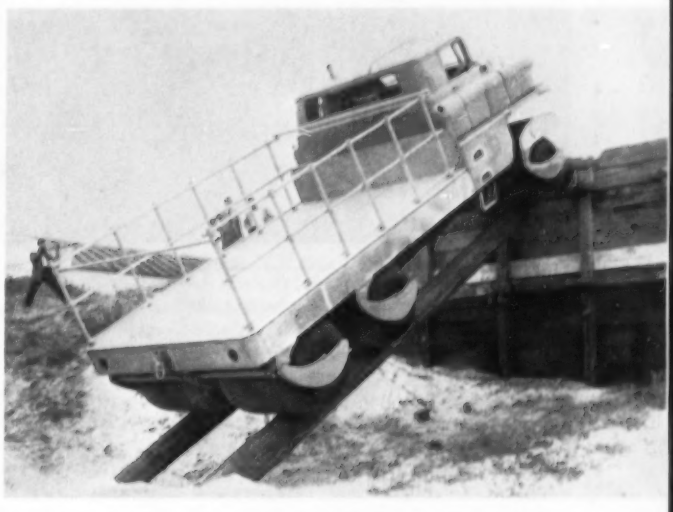
The wheels, that feel much like semi-inflated air pillows, spread their greatest contact area upon the ground, thus giving a broad distribution of the vehicle's weight and load. It is an engineering idea long used by Eskimos who transport heavy loads over rocky beaches with inflated sealskin bags. Because of the low pressure, the tires are expected to have as long a service life as conventional ones on a truck of similar capacity. The six 40x50-inch bags are inflated by a rotary air compressor controlled in the cab. The system is so rigged that air can be delivered to, and withdrawn from, each bag individually while the truck is either in motion or at a standstill. Thus the pressure can be regulated to suit the terrain. In both the commercial and "primitive" versions, the bags, when they meet rocks and obstacles, "flow" around them, thus providing an air-cushioned, shock-free ride.

The Albee Rolligon's wheels are top-loaded and driven instead of being axle-loaded and driven, as is the case in conventional trucks. All weight is placed on a small solid-load roller that is positioned just above the air-filled bags. As the pay load in the truck is increased, the axle does not move closer to the ground, but remains in the center of the roller. By the conventional method, the axle is forced closer to the ground, thus producing not only sidewall compression wrinkle and flexure, but also power-consuming bulges at the tread area. By keeping the bags essentially free of wrinkles, bulging and mushing—particularly at the ground tread area—the manufacturer claims that there is a decrease in rolling resistance and an increase in power.

Illustrated on the opposite page are various stunts being performed by the Arc; however, each has a practical application to off-road transportation problems. These pictures, for the most part, were taken during performance tests on the Rolligon last May at Monterey Peninsula, Calif. and at Pebble Beach.

1 Excellent traction is shown, at the right, as the Arc pulls a conventionally tired vehicle through deep sand. It is interesting to note that the low-pressure, air-filled bags supporting the vehicle leave no impression on the sand, whereas the tires of the second truck leave deep tracks. The pressure exerted by the bags on the ground . .

2 varies from 2 to 8 psi, depending on the load. This broadly distributed, low pressure is even more graphically pictured (left), than above, as the Arc rolls across the body of the inventor's wife, apparently without harming her. Showing how . . .



3 seemingly impassable obstacles can be taken in stride. the vehicle grips two logs (right) with its flexible "toes" and climbs a 16-foot-high wooden abutment. The angle represented is one of 70 percent. Similarly, timber can be placed over a narrow crevasse to permit easy crossing. Notice how the bags seem to "flow" around the logs. The same . . .

4 principle is true when the Arc meets large, sharp stones in cross-country travel, as shown at the left. Shocks are absorbed completely, and the boulders represent no obstacle. In the event that logs are not available, as above . . .

5 the Rolligon vehicle is capable of using man-made objects, such as the railroad tracks illustrated in the photograph at the right. Train trestles therefcre become access roads over canyons. Each of the "stunts" depicted on this page has a similar, although more practical, application for personnel ccncerned with off-the-road transportation.

World's Largest World

A storage tank for 600,000 cubic feet of natural gas serves a dual purpose: it provides a steady gas supply for customers of the South Atlantic Gas Company, Savannah, Ga., and serves as a map and study guide for residents of the city. Painted to scale, the Hortonsphere Holder is located in a residential area. When the gas utility had to have some type of storage facility to serve the rapidly growing southern section of the city, it applied to the Metropolitan Planning Commission for permission to erect one. The proposal encountered objections from citizens and clubs because it was thought that the tank might be an eyesore. Then H. Hansell Hillyer, president of the concern, suggested that the sphere be painted to scale to resemble a globe, thus making it an educational site. The citizens gave their enthusiastic approval, and the utility absorbed the extra costs of painting. The erected price of the sphere was $106,200, but an additional expense of $1200 was entailed for a special phosphoric-acid pickling process so that the structure could be painted to specifications. The paint job cost the company $6750. The total investment in the holder, including land and appurtenant structures was about $192,000. The globe is surrounded by a 6-foot-high brick wall. At its base is a marker giving airline distances from Savannah to all the cities of the world where Girl Guiding or Girl Scouting is practiced.

Doing Something About The Weather

IT has often been said that people talk about the weather, but that they don't do anything about it. This was not so in the case of Willis H. Carrier, for on a July day 55 years ago, he designed the first practical, large-scale air conditioner for William Lithograph Corporation's Brooklyn, N.Y., facility. It helped maintain more constant temperature and humidity, the immediate results of which were plates and paper that did not change in size, and register that could be held. The over-all effect was one of increased profit and better working conditions and employee efficiency.

Since 1902, air conditioning has become so widespread that it is virtually impossible to stay away from it; homes, offices and factories, restaurants and even automobiles let us live in comfort during hot, humid summer days. Even ocean-going passengers can enjoy its benefits. Lloyd Triestino Lines was the first to install an air conditioner aboard a passenger ship, the SS *Victoria*, in 1931. According to the records, though, units first went to sea on a cargo vessel in 1907; and later (1927), aboard a private yacht.

In the field of entertainment, Grauman's Metropolitan Theater in Los Angeles, Calif., was the leader; and Madison Square Garden in New York City became the first cooled public arena. Detroit, Mich., was the home of the first air-conditioned department store, the J. L. Hudson Company; and it was soon realized that sales volume increased as a result. Washington, D.C., felt the effect in 1925, as did a gold mine in Brazil that same year. Churches were caught in the trend in 1929, and 3 years later, the Santa Fe Railroad introduced it to its passengers.

It is interesting to speculate as to where the idea began. Perhaps it was with a man who observed bees taking water into their hives. Workers fanned the liquid with their wings to cool the stored honey. Asiatic and African tribal chiefs used fans made of large leaves attached to bamboo poles. A Roman emperor, suffering from the Italian summer, built a villa with double walls, between which was packed snow brought from the peaks of the Apennines. During the Crusades, Saladin, upon hearing that his opponent, Richard Coeur de Lion, had become sick with fever, ordered snow to be carried from the mountains near Damascus and placed about the Englishman's tent.

To the twentieth century mind, however, credit must be given for the practical development of cooling air. Thanks must be given for the increased profits in commercial facilities and for the added worker efficiency in factories, offices and the like. During the last decade, an inevitable boom in cooling took hold. Since World War II, 70 business buildings erected in New York City alone have yielded 22,840,000 square feet of cool office space. Twenty buildings now under construction will add another 10 million square feet.

The most recent application appeared in Las Vegas, Nev. A drive-in coffee shop has provided air conditioning for the interiors of its patron's cars. A central unit is located on the roof of the building, and its piping extends around the perimeter. Air is delivered to individual cars by means of 6-inch flexible ducts. These hang over each parking space when not in use and are pulled down by waitresses when an automobile stops. The tube's nozzle is placed in the car window, and a deflection device throws the incoming air over the ceiling of the vehicle, thus preventing direct drafts on the passengers. A small duct at the end of the system returns air to the central unit to assure uniform and constant delivery, no matter how many are using the facility.

EDITORIAL

Push-Button Peddlers

SOME of the most successful salesmen in this country last year delivered more than $1.9 billion worth of goods to consumers in every walk of life. And the sales parade goes on—every hour of the day and night, some 2¾ million people patronize vending machines. The army of robot merchants numbers 3¼ million units, and they are one of the country's fastest growing businesses.

Today's vending machines are almost uncanny. Many make change, some serve their wares piping hot, others ice cold, while some mix their product on order. From the more prosaic peanut machines, cold drink dispensers and cigarette vendors, the list goes on to machines that peddle whiffs of oxygen, test radio tubes or rent electric shavers. Some sell postage stamps, nylons, tooth brushes, aspirin, hand or shaving lotion, razor blades, combs, bobby pins, lipstick or hair oil. From some, one may purchase up to $62,500 worth of travel insurance. Robots can shine shoes, take pictures, record voices or grant an hour's look at television.

Vending machines have mushroomed since the end of World War II. Such devices as hot coffee machines, insurance vendors, subway or bus token machines and ones that cook a hot dog or hamburger (rare, medium or well-done) to order, have all appeared since then. Their ancestors have been around for sometime, however. A collar button dispenser put into use in San Francisco during the Gay Nineties still works—if fed a dime. The familiar cigarette machine was invented in 1927 by William H. Rowe. To a Chicagoan, Nathaniel Leverone, belongs most of the credit for the high standing of today's vending machines. In 1928, while waiting on an El platform for a train, he slipped a penny into a peanut machine that promptly coughed up a total of six moldy nuts. A chocolate machine gave him nothing for another penny, while one scale told him he weighed 98 pounds and another shocked him with the revelation that, during a 10-second interval, he had gained enough to weigh 205 pounds. Actually he weighed in the mid-hundreds and, in the vernacular, he blew his top. With $60,000 he started the Automatic Canteen Company of America, and demonstrated that reliable machines, honestly valued merchandise and neat, uniformed service men could make the vendors pay off handsomely. (The firm is the largest in the field today, annually grossing around $90 million.)

The pathway to success has been a rocky one. Early machines were much distrusted and some rightly so. Many of today's successful operators freely admit that the criticism was well deserved. But they also point out that there is something about the coin machines that brings out the very worst in some people. Perhaps, they say, it's because of their superficial resemblance to slot machines that many people feel that it is alright to try to beat the machines any way possible. One machine owner, for example, in the early days reported that his take for 1 week from one machine totaled $9.65 in nickles and $10.10 in slugs. Another few dollars worth of candy bars had disappeared from his machine because slick operators had retrieved their coins by tying a thread or thin wire to them. As one vendor owner put it, some people work harder to get a nickle out of a machine than they ever would to earn one. By the time machine designers came up with such things as coin weighers and measurers as well as thread and wire snippers, the situation had become a national joke.

By 1938, the machines had won a reputation not only for honesty and reliability, but for foiling would be cheaters as well. It was just a few years later that industrial and office managers discovered that a candy bar or soft drink actually improved efficiency, and the vending machines found their way into thousands of locations previously inaccessible. Plants and offices still represent the most lucrative locations for the robots. In some small plants, where a company-owned or sponsored cafeteria is not feasible, machines serving soup, sandwiches, and even complete meals, have proven an admirable substitute.

The vending machine business today is made up mostly of small operators. Indeed, it is said that eight of every ten machines are owned by independent operators, and almost one-quarter of the nation's 5600 vending firms are 1-man operations. Many stories are told of rags-to-riches operations, but today it is getting harder and harder to start out on a shoestring. Back in the '30s a fairly reliable cigarette machine could be purchased for about $50 to $60; one now costs from $200 to $250, largely say manufacturers, because of the wide range of brands that a successful machine must offer. A cold drink dispenser, because of its complicated mixing apparatus and its refrigeration unit, costs about $900, while some food vending machines run as high as $1500 to $2000 or more. Small, penny-operated peanut or gum machines can be had for as little as $15, but the margin of profit on such goods is so small that they are usually money makers only if installed in conjunction with cigarette or candy machines where they can be serviced without making a special trip.

The industry is looking forward to boom times. Already hints of things to come are glimpsed in occasional supermarket vending machines. Installed outside the store, the robots offer 24-hour service on such staples as bread, milk, salt, sugar, tea and coffee.

Manufacturers say that there is almost nothing that they can't build a machine to vend. Most believe that rising sales costs will sooner or later force more and more retailers to turn to machines, thereby dispensing with sales clerks that sometimes are busy and sometimes not.

This and That

Aluminum Oil Well Drill Rig

At Lake Maracaibo, Venezuela, can be seen the world's first aluminum offshore oil well drilling platform. It is the first of four that are to be installed there. The structures were prefabricated and welded together. The first to be erected rises 111 feet from the bottom of the lake, however the others will reach heights of 121 feet. Designed by J. Ray McDermott & Company of New Orleans, La., with metal produced by Reynolds Metals Company, it is hoped that the structures will overcome the problem of extreme corrosion in the lake. The aluminum alloy used was first tested for several years in Maracaibo before it was deemed suitable for the rigs. The first platform was erected in just 5 days, and is completely portable; whereas formerly used concrete-piling drill rigs required 25 days to install. The only steel on the units is located in the decking and the piling. All parts exposed to the water are of the alloy.

* * *

Wanted! Dead-Arm Brandt

Be on the look-out for *Dead-Arm Brandt;* a generous reward is offered. Dead-Arm isn't a criminal, its the name of a dime-thriller dealing with the early days of oil. Collectors, it is reported in *Petroleum Newsnotes,* are willing to pay upwards of $100 for a copy. Purple prose and bad grammer notwithstanding, most of such early tales were written by men with an intimate knowledge of their subject. They contain accounts of how nitroglycerin was used to blow oil wells, early refining methods and financial risks involved in the pioneer oil industry. These pulps may prove to be of more historic value than formal treatises because they manage to capture the spirit of the times. At least fifteen dime novels about oil have been uncovered, and collectors are scouring cellars and attics for new finds.

* * *

Program Moonbeam Announced

A program by which amateur radio groups can take part in the International Geophysical Year earth satellite program has been inaugurated by the National Academy of Sciences, America's IGY sponsors. To be known as Moonbeam, the program will organize amateurs and provide them with technical information about the operation of simplified tracking systems. These will make it possible for volunteers to locate the satellite in its flight and to receive scientific data transmitted from it. The Naval Research Laboratory heads the project, assisted by the Jet Propulsion Laboratory of the California Institute of Technology. The American Radio Relay League will give active support to the effort. Two electronic systems have been developed to be used in tracking the satellite, and it is believed that their cost is well within the reach of interested amateur associations.

The information gathered by these people will be of great value to the scientists. Moonbeam teams will be able to provide data about small deviations in the satellite's orbit that will reveal local irregularities in gravity. In addition they may be of great aid in initially locating the tiny moon after it has been launched, in providing additional observations on the effect of the ionosphere on radio signals, in providing time and position checks, and in gathering data should serious damage to the satellite occur. A related program for tracking the satellite visually, known as Moonwatch, is under the direction of the Smithsonian Astrophysical Observatory. This program and another, covering camera tracking, are designed to appeal to amateur astronomers.

* * *

Scale Model Mountains

One oil company uses a unique mountain-building machine to reconstruct the earth on a miniature scale. Sheets of rubber and clay representing rock layers are placed in a box having hinged sides, thus allowing deformation of the container. By applying varied pressures to different sides of the box, folds equivalent to hills and mountains can be formed in the clay and rubber layers. Using this machine, scientists hope to get a clearer picture of how and where oil traps are formed.

* * *

Ceramic-Coated Aluminum

Ceramic coatings have successfully been applied to the so-called strong aluminum alloys. The step is the result of a joint research effort sponsored by Gulton Industries and Lithium Corporation of America. Heretofore, attempts to porcelain-enamel certain structural aluminum alloys resulted in blistered, brittle surfaces along with warpage of the base metal. Tests were performed on 0.04-inch-thick aluminum sheet having a 0.0015-inch-thick ceramic coating. Specimens subjected to a flame impingement test for a period of 2 hours at a flame temperature of 2200°F reportedly showed no ill effects. The temperature as measured at the coated surface was 1700° to 1800°F. The same flame burned a hole in a noncoated specimen of the same thickness in about 30 seconds. Availability of the ceramic-coated alloys is expected to be a boon to aircraft designers. Previously, stainless steel alloys weighing a great deal more had to be used to withstand the high temperatures of supersonic and hypersonic flight. With the coated aluminum, the weight of certain parts can be cut to about one third that of comparable steel parts

PHOTO, JOHN GRINDROD

AIR-CONTROLLED TRACTOR

The tractor shown above is unconventional both in appearance and design. The 2D, as it is called, is manufactured by David Brown Tractors (Engineering) Ltd., England, and made its first appearance last year at the Smithfield Show. It has a small built-in air compressor that provides an inexhaustable power source for lifting and lowering the implements. The main frame of the vehicle is used as the compressed-air reservoir.

while still retaining adequate strength in the 300° to 700°F range. Lithium chromate, lithium borosilicate and lithium fluoride compounds were used in the research. Reportedly aluminum sheets can be bent, drilled, punched and sheared without damage to the coating.

* * *

One-piece Canvas Tents

An engineer in Sweden's Tele Administration, tired of the time-consuming project of mounting tents while on field duty, decided to make one that could be put up quickly. The result of his work is a design that has been patented in many countries, and that should be of interest to car owners, campers and field workers. The frame structure of the model consists of metal parts that are easily connected and detached. The erection of larger models is facilitated by the fact that the 1-piece canvas may be placed on the assembled structure before it is raised. The unit is free-bearing, and there are no central poles. Entrance doors are able to be locked, and fold out so that the gable end is completely open. This is achieved by dividing the end flaps into three pieces, the central one of which consists of a V-shaped section which is rolled up, whereupon the side ones are folded back. This allows ventilation at the top and admits light without exposing the user to uncomfortable drafts. It is possible to obtain the tents with detachable windows which do not have to be removed when folding for transportation. The larger models can be used for canteens and field hospitals; the medium sized ones, for garages and camping; and the smaller are ideal for individuals.

Twister Warning Devices

Tornado, Inc., an Oklahoma City, Okla. manufacturer, is selling Twister Alarms. The devices are battery-powered and are designed to warn of approaching storms. It consists of a barometer with an electrical contact point. When the atmospheric pressure drops to 29.1, the contact is made and a high-frequency buzzer sounds. Thus, the low-pressure areas that surround such storms would set the alarm off in much the same way as high temperature actuates a fire-sprinkler system. It is reported that already about 3000 orders have been placed for these small, aluminum-cased alarms.

* * *

Radio Traces Salmon

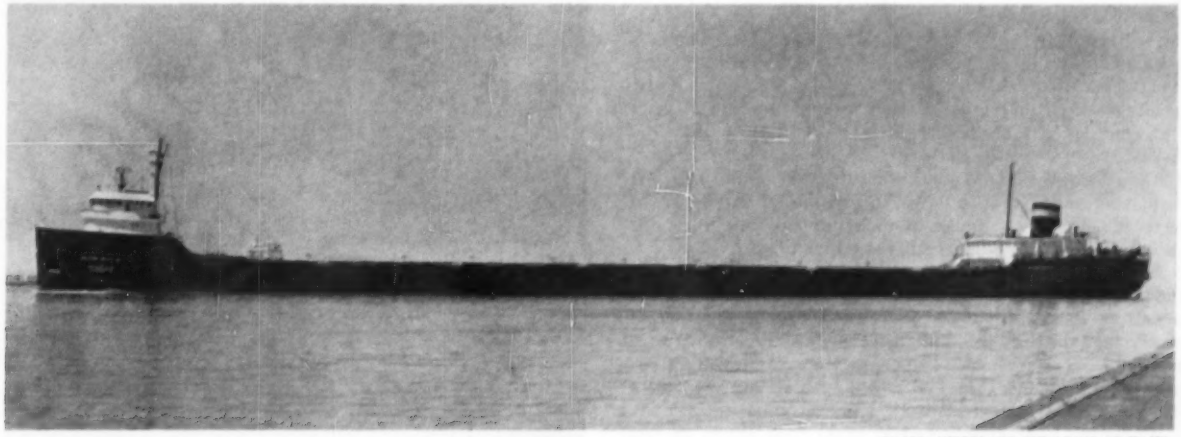
Scientists from the United Nations have developed a radio device that can be attached to fish to trace their movements. It consists of a very small ultrasonic oscillator which is placed in a capsule. The container is then clipped to a salmon behind the dorsal fin. It is reported that the device can be fitted without handling the fish while it is isolated in a small enclosure near the surface of the water. Radio apparatus in a boat picks up the sounds transmitted by the oscillator. By means of special instruments, the course and depth of the swimming fish can be charted.

The need for the invention was born with the construction of dams and powerhouses for hydroelectric projects along major river systems in the United States. This building created a problem for migratory fish, especially the salmon, that move upstream to spawn during regular season. Bypasses, or salmon steps, were devised, but the turbulent water at these points makes it difficult to follow the fish's course.

* * *

Mexican-American Gas Line

The first large quantity of natural gas ever to enter the United States from Mexico started to flow August 22 when a valve was turned to admit gas from Petroleos Mexicanos lines to the Texas Eastern Transmission Corporation's network. Initially, imports will total 126 million cubic feet per day (cfd). This amount will be increased to 200 million cfd as additional reserves in Mexico are tapped. The gas is part of an expansion program through which Texas Eastern plans to increase its system capacity to 1634 million cfd. The gas comes from the Brasil, Trevino and Lomitas fields in northeastern Mexico. It is first processed at the Pemex natural gas processing facility at Reynosa, then is delivered to Texas Eastern at the international border just below McAllen, Tex., and on the Rio Grande River. Texas Eastern received Federal Power Commission authorization in 1956 to construct a link from its Vidor, Tex., compressor plant, along the Gulf Coast, to the McAllen border crossing. The line was completed this summer at a cost of $44 million. Besides handling the supply from Mexico, the 30-inch-diameter line will also be used to transport gas gathered from numerous fields along the Gulf Coast. Special ceremonies were held to mark the start of operations and included representatives of both governments as well as officials of the two companies.



PHOTO, INTERLAKE STEAMSHIP COMPANY

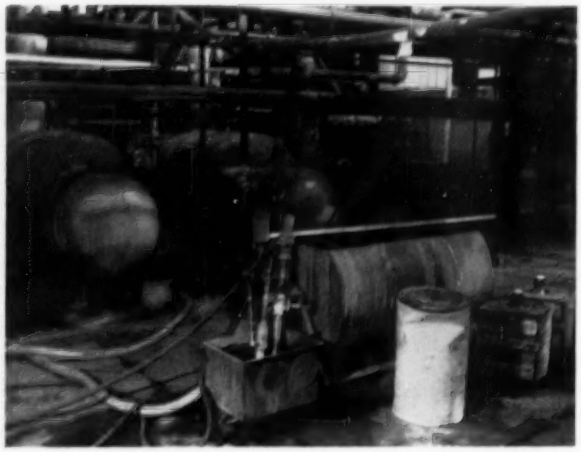
MAKING A SHIP GROW

The S. S. *Elton Hoyt 2nd*, flagship of the Interlake Steamship Company became one of the longest bulk carriers on the Great Lakes last winter when a 72-foot-long midsection was added to the previously 626-foot-long hull. Floated into a drydock at the Chicago yards of the American Shipbuilding Company last February 20, the hull was cut in half. After severing it, marine engineers responsible for the job reflooded the drydock, and also filled with water the after portion of the vessel. The forward section was then floated ahead and carefully positioned so that the new section would just fit into place. Then the drydock was pumped out, and the new section of the vessel built into the gap. The *Elton Hoyt* is now 697 feet 6¾ inches long. She has a total of 21 hatches, three more than on the old vessel, and her cargo capacity has been increased by about 2500 long tons.

SAVING WITH AIR POWER

Air-Operated Sump Pump

CLEANS REFINERY EQUIPMENT



VARIOUS types of refinery equipment, such as heat exchangers, water jackets, pipes, and the like, accumulate internal deposits from water used in them. These formations must be removed periodically. At an oil refinery in Heath, Ohio, the cleaning was generally done by an outside contractor who pumped acid through the equipment with a steam pump. Costs were reportedly high, and an effort was made to reduce them.

The facility built a portable mixing tank for the acid with an external sump, as shown left. An Ingersoll-Rand Company Size 25 sump pump was placed in the latter, and its discharge hose was connected to the machinery needing cleaning. Because a slow rate of circulation was required, the unit operated at part throttle and was often connected to more than one piece of equipment at a time. A hose was attached to the opposite end of the unit being cleaned, thus returning the acid to the mixing tank. Generally, the solution was circulated for several hours, after which an inhibitor was sent through. Only the impeller on the sump pump was seriously affected by the acid; however, the company realized that its replacement cost was negligible considering the savings made over previously used methods.

Shop-Built Rope Tester Promotes—

PLANT SAFETY

TO DETECT and eliminate weakened rope slings before they fail under load, engineers at Calumet & Hecla's Wolverine Tube Division, Detroit, Mich., designed and built a simple, rugged, mobile rope tester out of spare parts. The device, pictured at the right, is a part of the plant's over-all safety program.

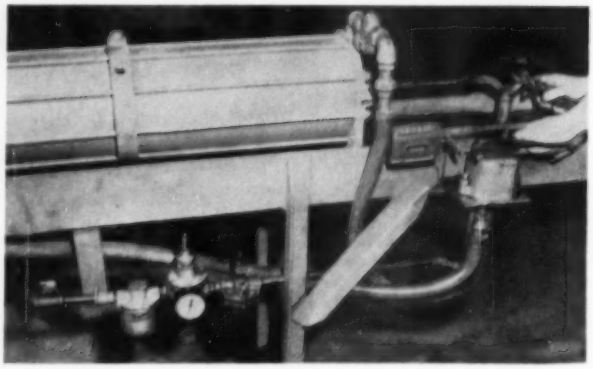
The framework of the tester consists of an 18-foot-long H-beam, supported by four braced angle-iron legs welded to the beam's flanges. Each pair of legs is supported on a length of U-channel, mounted on casters.

An 8-inch air-hydraulic cylinder with a 15-inch stroke, taken from a scrapped machine, provides the force for testing. It is bolted to the web of the H-channel, and a hook is mounted on the cylinder plunger. The cylinder hook runs in a groove so that it does not twist as the rope is put under tensile load. A double hook, that can serve either 6- or 8-foot rope lengths, is mounted at the opposite end of the H-beam.

Air at a pressure of 80 psi is supplied to the unit. A regulating valve steps it down and maintains a pressure of 38 to 40 psi to the cylinder. A moisture trap and lubricator have been inserted in the compressed air line.

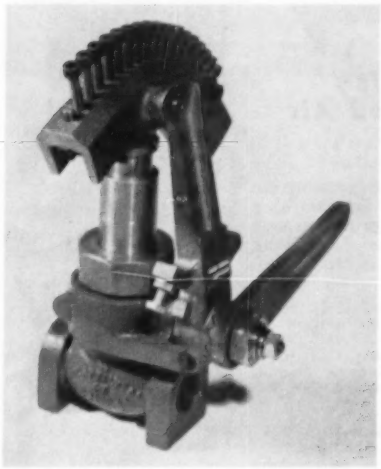
A rope sling is mounted for testing by slipping the loop ends of the sling over the hooks. The operator then opens the air valve to the cylinder, thereby applying a 2000-pound tensile load on the sling. The load is maintained until rope creepage stops. A sling in satisfactory condition will "give" to a certain extent, but then it will hold steady. A faulty one will continue to creep until a breakage occurs.

Wolverine uses approximately 5000 rope slings in two lengths to handle unit loads of tubes in process. A testing schedule assures that every rope sling used in the plant is checked once a month. To keep a quantitative record of the tests, a Veeder counter was mounted on the unit. It is linked to the air valve so that actuating one automatically moves the other. The worker records the counter reading both when he starts testing a group of slings, and again when the tests have been completed.



Industrial Notes

Atlas Valve Company has announced a metering control valve for industrial oil burner installations. It has a flexible sheet metal cam, the contour of which is adjusted by a series of 24 screws. The

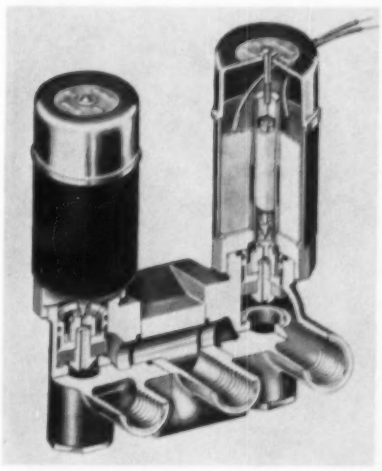


cam is attached to a lever that moves it in accordance with a demand motion from one of two variables. A roller on the stem presses against the cam and in following the pattern of the cam adjusts flow through the valve. Designated as Type 235, it is designed to control and maintain a flow ratio between two fluids such as air and fuel oil, and reportedly may be used in applications that must be kept within specified ratios.

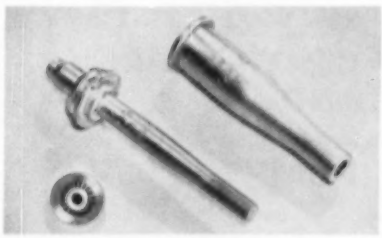
Circle 1E on reply card

A double solenoid valve introduced by Atkomatic Valve Company, Inc., provides 3-way flow control. As a mixing unit, it has two inlets and a common outlet; for divided flow, one inlet and 2 outlets; and as a cylinder control device, it utilizes inlet, cylinder and exhaust connections. A packless unit, it has two pilot pistons, each controlled separately. It is bubbletight and according to the manufacturer, may be used at pressures ranging from 5 to 1000 psi. It is available in ½- and ¾-inch pipe sizes for bronze.

Circle 2E on reply card



Increased flame-cutting speeds are possible, it is said, with a complete selection of Oxweld 2-piece nozzles developed by Linde Company, a division of Union Carbide Corporation. Designed for use with oxygen and fuel gases, each fixture has from 12 to 20 extremely small outlets for preheat gases—more than double the number in conventional nozzles. This increases the rate of heat transfer



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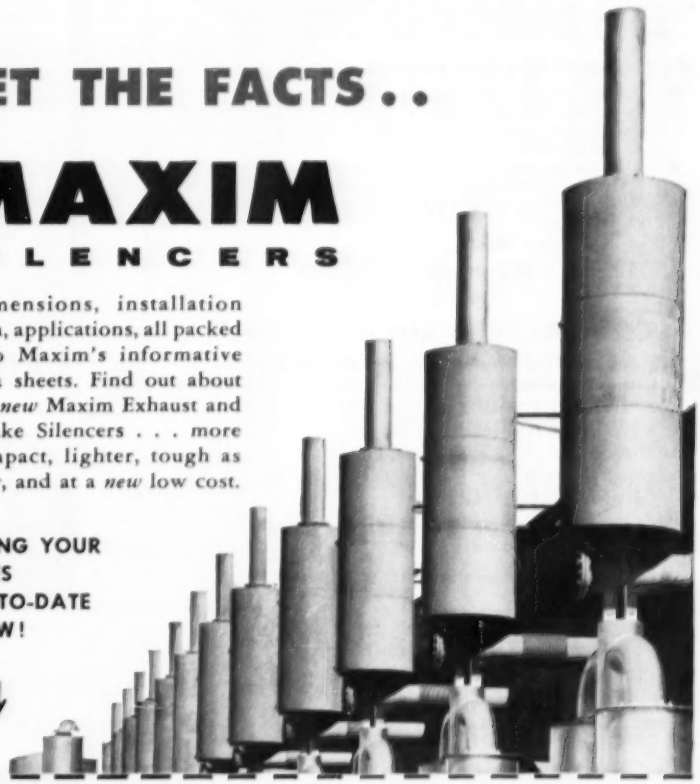

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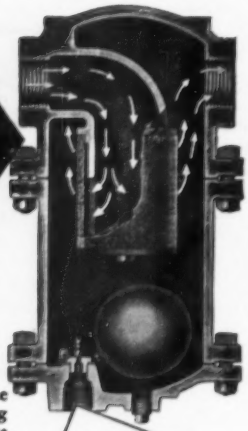

Johnson Self-Draining Compressed Air Separator . . . . . .

Like all Johnson Separators the new Type "SA" Self-Draining Separator combines the two most effective principles of removing moisture and dirt from compressed air:

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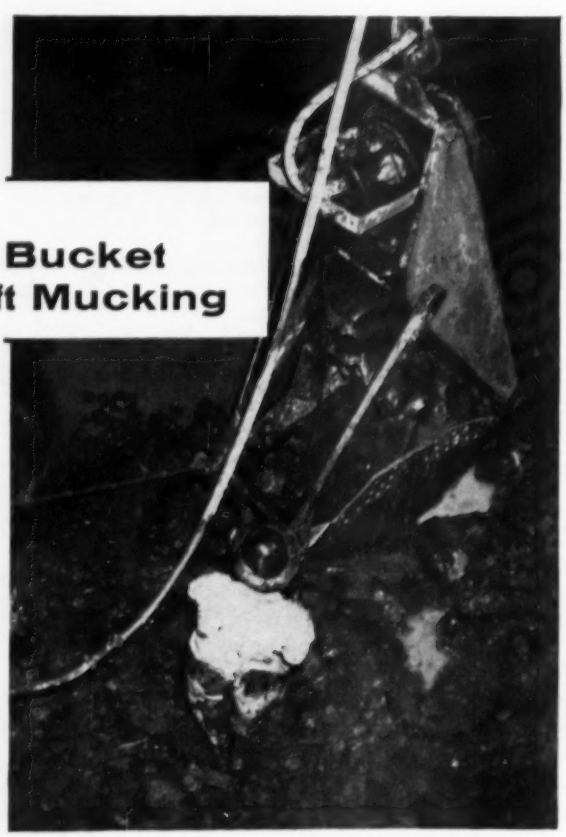
"This is the best thing I've found in Air-operated Clamshells"

states James Williamson of
Williamson Shaft Contracting Company about

The New Blaw-Knox Air-operated Clamshell Bucket for Excavating and Shaft Mucking



These words come from a man who has been in the shaft contracting business since 1900. He goes on to say, "It loads faster and has much more closing power. I believe that its balance and streamlining make it much safer to operate."

This new Blaw-Knox air-operated clamshell bucket is suspended from a single cable, operates on normally available 85 to 100 pounds air pressure. It is controlled by a chain release connected to the walking beam type closing and opening valve.

The ¾ cu. yd. size accommodates either the Ingersoll-Rand Model H-U or Gardner-Denver Model HK air hoist. The ⅝ cu. yd. size accommodates either the Ingersoll-Rand Model H-5-U or Gardner-Denver Model HM air hoist. The hoist you specify can be factory- or field-mounted.

For descriptive bulletins or further information, contact your nearby Blaw-Knox Bucket dealer or the factory.

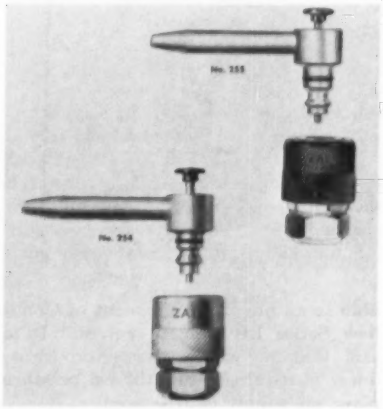
BLAW-KNOX COMPANY
Blaw-Knox Equipment Division
Pittsburgh 38, Pennsylvania

Circle 15A on reply card

and produces a nearly solid ring of preheat flames. Ring preheating is ideal in shape-cutting operations because the metal is uniformly prepared regardless of changes in the direction of the cut. Gases leave the cutting nozzle at a rate of about 1200 feet per second, thus substantially boosting cutting speeds. Each consists of a brass internal section with finely grooved slots for preheat gases, and a heat-resistant copper cover. The nozzles are easily cleaned with a cloth or soft wire brush.

Circle 3E on reply card

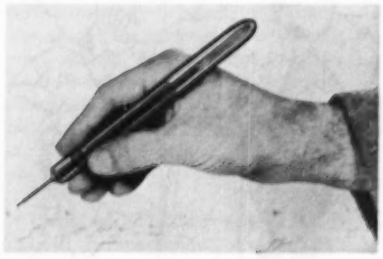
An air blow gun introduced by Zalo Manufacturing Company is lightweight and rugged. It is made of accurately machined steel components; no parts are die cast. Simplified design has elimin-



ated springs, valves and rubber seals. The units are made in two models—Series 254 and 255—to fit many existing air line connections. According to the manufacturer, the gun will fit Zalo 250, 255 and PT couplers.

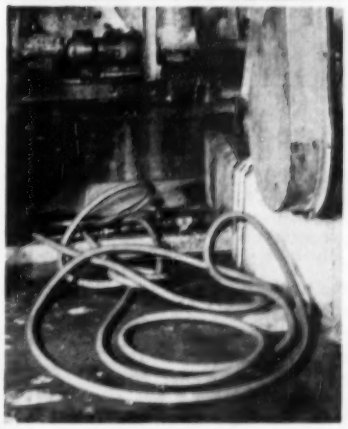
Circle 4E on reply card

A precision-made, fountain-pen-like oiler delivers exact amounts of oil in small quantities. It operates vertically or horizontally in holes ⅞-inch deep and in out-of-way places that are ordin-



arily difficult to reach. The spring controlled steel point is simply pressed against the spot to be oiled, then released. The oil supply is visible in a transparent reservoir. Because of its pin-point control, the unit, according to

Use One Hose for Many Jobs!



GOODALL

"ALLSERV"

General Purpose

HOSE...

"ALLSERV" will not only give long, reliable service on air and pneumatic tools, but will prove equally efficient in the handling of water, oil, gasoline, paint and insecticide spraying, grease guns, etc. The adaptability of this one hose to such a wide variety of applications provides a sure way to keep hose inventory low.

"ALLSERV" is a very flexible all-"Synplastic"® molded-and-braided hose, in one, two or three braid construction, with a tough wear-resistant red cover. Made in sizes ¼" to ½", for working pressures from 200 lbs. to 300 lbs.

"If it's GOODALL, it MUST be Good!"

Contact Our Nearest Branch for Details and Prices

Standard of Quality—Since 1870

HOSE · BELTING · FOOTWEAR · CLOTHING AND OTHER INDUSTRIAL RUBBER PRODUCTS

GOODALL *Rubber Company*

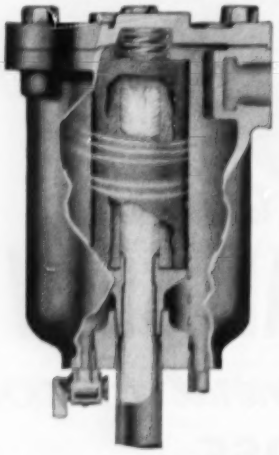
GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES. IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.

Circle 16A on reply card

ADAMS PORO-STONE AIR FILTER

designed to remove oil, water and foreign matter from compressed air lines with minimum pressure drop.



The R. P. Adams Poro-Stone air filter is engineered to efficiently remove entrained oil, water and pipe scale from compressed air lines. Liquid droplets and solids being carried by the gas stream are first removed by centrifugal action in an annular chamber. Secondary filtration is achieved by passing the air or gas stream through a Poro-stone unit. An automatic trap can be provided to discharge the residue from the cyclone chamber.

At rated capacity the filters operate at a maximum pressure drop of only ½ lb., thus insuring delivery of line pressure to the point of consumption.

The units require virtually no service or maintenance — thereby insuring continued trouble-free, low cost performance.

ADAMS Poro-Stone air filters are available from stock in sizes to suit your needs. For further information, write today for Bulletin 117, R. P. Adams Co., Inc., 209 East Park Drive, Buffalo 17, New York.

Circle 17A on reply card

NON-FLUID OIL

TRADE MARK REGISTERED

ELIMINATES PNEUMATIC TOOL TROUBLES

Use of "NR" grades of NON-FLUID OIL has solved the problem of moisture content of compressed air in pneumatic tools. These superior lubricants **absorb** the moisture from compressed air into a complete emulsion, making the air part of the lubricating film. This means:

- Complete rust-proofing of air tools.
- Elimination of gumming of moving parts.
- Reduction of friction and increase of speed.
- More work production in same number of hours.
- Reduction of tool maintenance costs.

If you are not now using NON-FLUID OIL "NR" grades in your pneumatic tools, send for a free testing sample and bulletin 550.

NEW YORK & NEW JERSEY LUBRICANT COMPANY

292 MADISON AVE., NEW YORK 17, N. Y.
WORKS: NEWARK, N. J.

1896 61 YEARS OF LUBRICATION SERVICE NON-FLUID OIL TO INDUSTRY 1957

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Birmingham, Ala.	Greenville, S. C.	Greensboro, N. C.
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Columbus, Ga.	Springfield, Mass.	Providence, R. I.
Charlotte, N. C.		St. Louis, Mo.

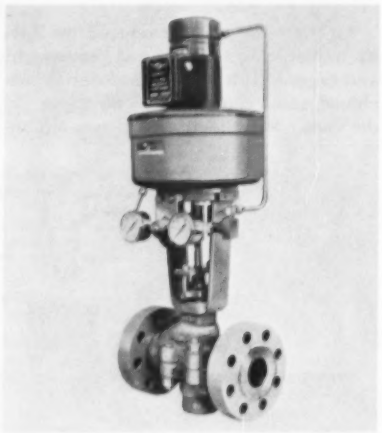
NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 18A on reply card

Dill Manufacturing Company, eliminates the waste and accompanying mess common in oil can use.

Circle 5E on reply card

Model "E" Electro-Pneumatic valve positioner reportedly eliminates the inherent transmission lag of all-pneumatic systems. Valve openings are adjusted in direct proportion to the strength of direct-current signals received from electronic instruments. It is a development of Conoflow Corporation and is available as an integral component of Conoflow Series LB Control valves. It is said that no electro-pneumatic transducer is required—full 100-psi pressure plant air supply can be used.

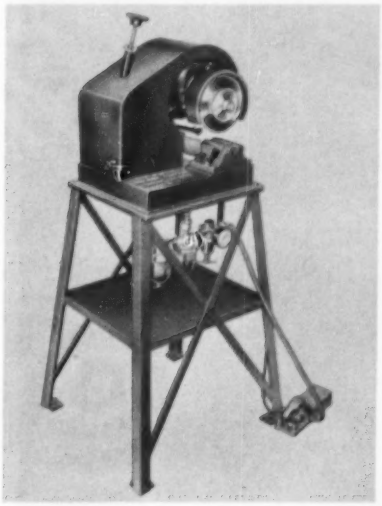


Circle 6E on reply card

As many as 2000 pieces of pipe and tubing, ranging in size from ⅜- to 1¼-inch O.D. in light- to 16-gauge wall thickness, can be cut per hour on an air-operated, rotary cut-off machine, according to Continental Machine Company, the manufacturer. The operator feeds the material to a preset stop, touches the air valve foot switch, and

"You know this living just to pile up money day after day is disgusting—I'll certainly be glad when I've got my pile made."

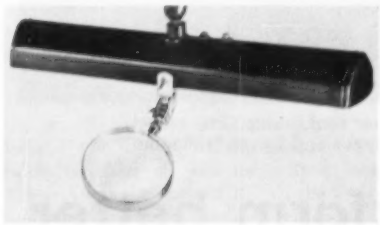
the rotary blade descends at the desired cutting speed, passing through the ma-



terial, leaving a clean, smooth edge. Air operation eliminates worker fatigue, permitting steady, high-production rates. For intermittent use, a handle can be attached for manual operation. Adjustable pipe and tube support tables are available with nylon fork rollers to minimize scoring of material.

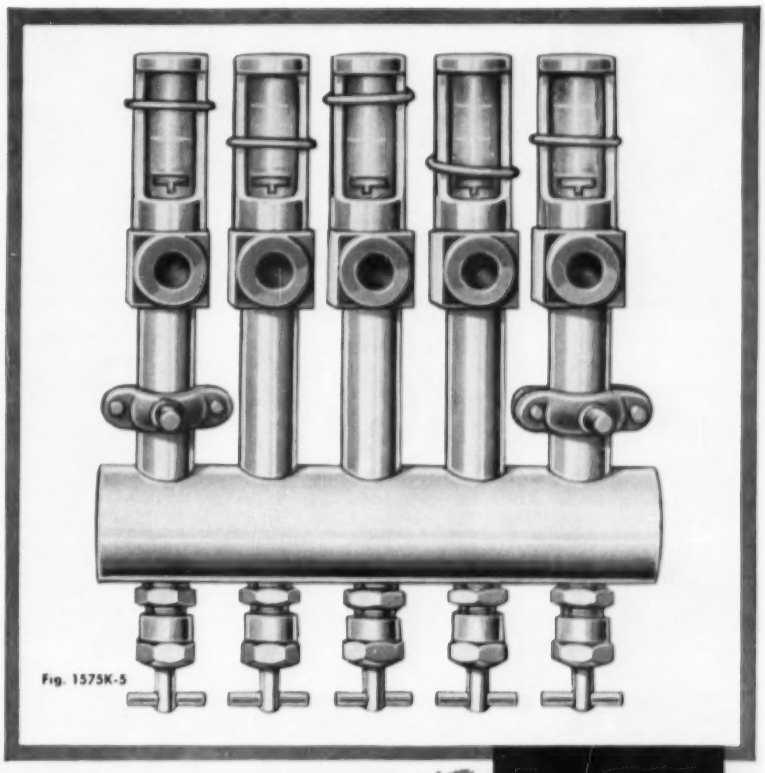
Circle 7E on reply card

Mounted on work or inspection benches, draftsmen's lamps, machine tools, or wherever instruments require



precision setting, Edmund Scientific Company's 4-inch diameter, plus-5 Diopter magnifiers adjust to any position with one hand, reportedly give optimum magnification for ordinary use, and speed up gauge readings and parts comparison. The large diameter permits use of both eyes so that a 3-dimensional effect is obtained. The precision-ground lens has an 8-inch focal length, and the sturdy metal mount swivels freely to all positions. *Circle 8E on reply card*

Using a self-compensating, floating pulley arrangement, Ratex Instant Speed Variator permits changes in machine speeds without stopping the motor. It is ideal for drill presses, machine tools, power and feed controls, conveyors, timing experimental devices, etc. A variable speed range of a 6½-to-1 ratio is obtainable with finger tip control, ac-



NEW

. . from NUGENT

PRESSURE SIGHT FLOW LUBRICATORS

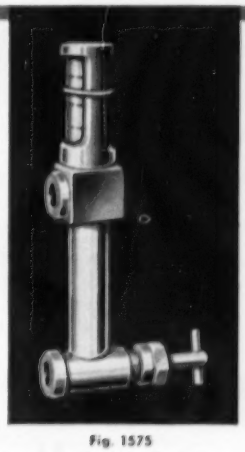


Fig. 1575

Now you can deliver lubricating oil or other liquids under pressure, in accurately measured quantities, to high or otherwise inaccessible points with the Nugent pressure sight flow lubricator. They are available as single units or in multiples to 15 depending upon the number of feeds required.

Each lubricator making up a multiple unit is capable of feeding fluid in amounts varying from several drops to two pints per minute by simple adjustment of the individual needle valves.

Single lubricators are available with 1/4" or 3/8" ips inlet and outlet. Inlet sizes of multiple units range to 3/4" ips with 1/4" or 3/8" ips outlets. All are designed for 125 psi maximum working pressure.

Write for complete details.

Established 1897

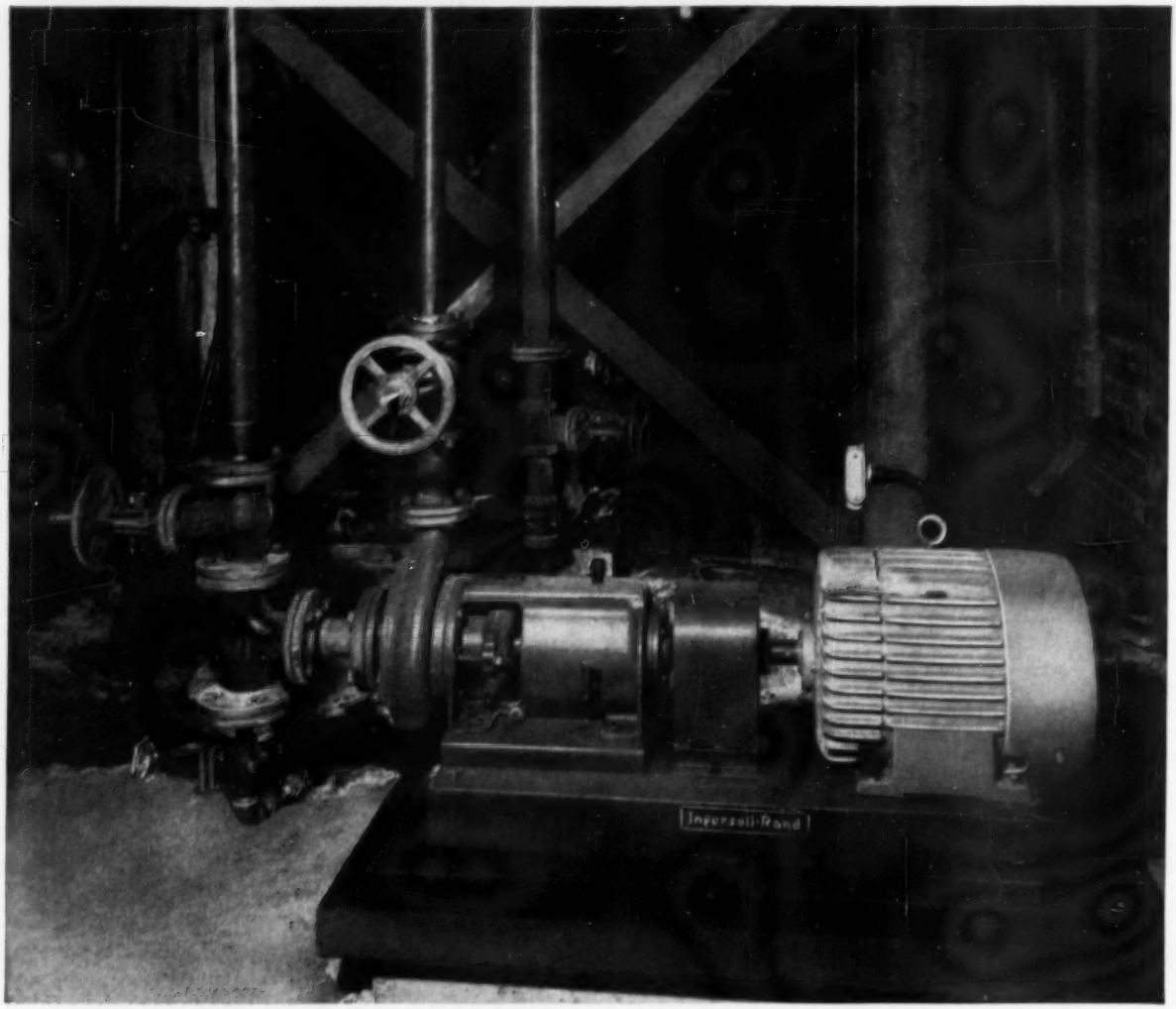
Wm. W. Nugent & Co., Inc.

3434 Cleveland Street Skokie, Illinois

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

Representatives in Boston • Cincinnati • Detroit • Houston • Los Angeles • Minneapolis • New Orleans • New York • Philadelphia • Portland, Oregon • San Francisco • Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver

Circle 19A on reply card



IRCAMET chemical pump at Stauffer Chemical Company, Niagara Falls, New York. IRCAMET is an Ingersoll-Rand alloy containing 29% nickel, 20% chromium, 3% copper and 2% molybdenum.

Pumps that last longer, perform better, usually have nickel alloys in them!

Take Ingersoll-Rand's 2-MC chemical pump (above).

It handles a 13% caustic solution at 130°F. Pumps it at a rate of 240 GPM against a 40-foot head.

The casing and impeller parts that contact the caustic are made of IRCAMET, Ingersoll-Rand's nickel-chromium-molybdenum cast alloy. The shaft is made of nickel-chromium austenitic stainless steel.

The nickel content of both IRCAMET and stainless helps give these critical parts excellent resistance to the corrosive attack of caustic. Just what's needed!

Your pump problem may be altogether different!

Perhaps it's one involving erosion . . . strength . . . pressure tightness . . . weight reduction . . . wear. Or a combination. If it's any of these factors, nickel-containing alloys will usually extend the useful life of your equipment. And make it perform better!

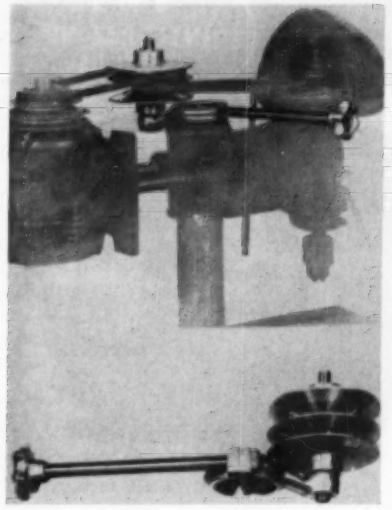
For information to help you select the right alloys containing nickel, write to us. We'll be glad to help you with your metal problem.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO TRADE MARK

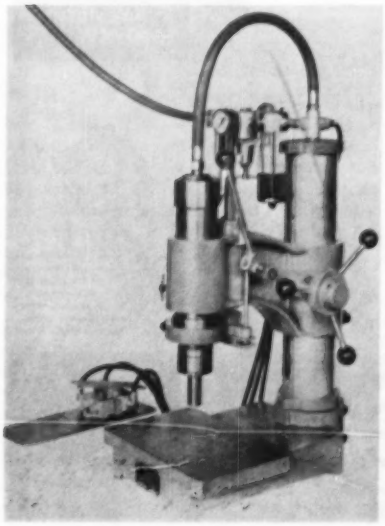
INCO NICKEL

NICKEL ALLOYS PERFORM BETTER LONGER



cording to The Custanite Corporation, its manufacturer. The unit fits any standard 2¾-inch drill press support post without the use of tools. Angle brackets for special installations in either horizontal or vertical positions are also available. *Circle 9E on reply card*

Model 300-RH is the largest such unit in a Repeating Hammer (RH) series made by Heidrich-Nourse Company. It is a heavy-duty machine with a wide-range capacity. An air-traverse mechanism, controlled by a foot valve, lowers a hammer cylinder to bring the percussion tool down onto the work and hold it there during the cycle. Valving is internal and is actuated by this contact. So long as the contact pressure is maintained, the hammer will repeat from 1000 to 2500 times per minute, depending on the air pressure used. Upon release of the foot pedal, the hammer cylinder is lifted up and away from the work. On a pressure of 20 psi, the hammer has a gentle action and will handle



DRY AIR . . .
PRECISELY as you want it

- to control your product's quality
- to prevent condensation on your product or material
- to prevent changes due to moist air in contact with your product
- to protect your material from dampness
- to protect your processing of moisture-sensitive material
- to DRY your material or product
- to pack or store your product safe from moisture damage
- to get exact moisture control for the precise atmosphere condition you need
- to provide precise atmospheric conditions for testing
- to increase your air conditioning capacity
- to DRY large quantities of fresh air from outdoors

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always.

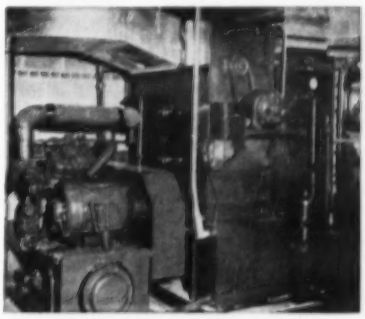
Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.



AT THE
CHEMICAL SHOW
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Coliseum, New York City, December 2 – 6, 1957
See NIAGARA . . .
AIR CONDITIONERS • Aero HEAT EXCHANGERS
Aero AFTER COOLERS • Aero REFRIGERANT CONDENSERS • Aero STEAM CONDENSERS
Aero VAPOR CONDENSERS • HUMIDIFIERS
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BOOTH No. 655

Write for full information; ask for Bulletins 112 and 121. Address Dept. CA-10

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405 Lexington Ave., New York 17, N. Y.
District Engineers in Principal Cities of U. S. and Canada

Circle 20A on reply card

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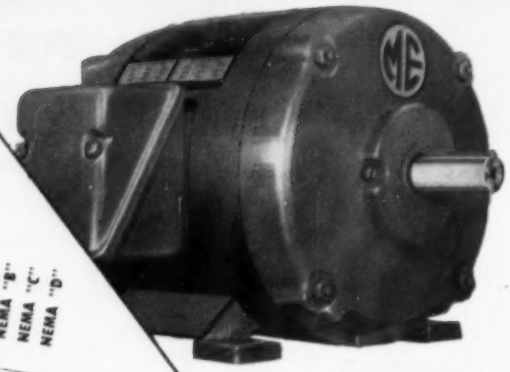
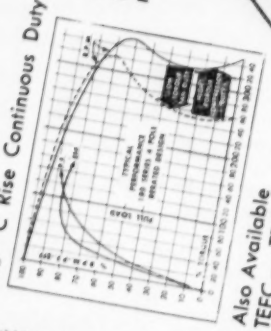
MARATHON ME ELECTRIC
MOTORS — GENERATORS

4 in 1 INTEGRAL HP MOTORS



New NEMA Frames 182 thru 326U

Designs: NEMA "B" NEMA "C" NEMA "D"



Specifications: 40° C Rise Continuous Duty

Also Available TEFC — TENV — and Explosion Proof

All ME Fractional Panel Mounted Units Carry Label in 1/12 HP Through 250 HP Ratings

It's
- ✔ Splash-proof
- ✔ Drip-proof
- ✔ Guarded
- ✔ Weather Protected

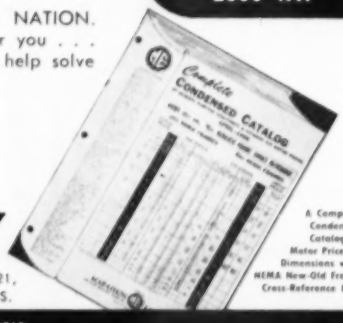
- EXPERIENCE . . . PROVEN PERFORMANCE. There is no substitute for the reliability of proven performance . . . Top Names of the Nation's Industry have proven ME performance in PRODUCING QUALITY PRODUCTS.
- VERSATILITY . . . WIDE RANGE OF DESIGN. Single Phase . . . Polyphase . . . Direct Current NEMA Standard . . . or Special Design ME can design to meet your special specifications.
- SERVICE . . . THROUGHOUT the NATION. There is an ME District Office near you . . . Call our Sales Engineer TODAY to help solve your motor problem.

MOTORS 1/20 HP thru 2500 HP

GENERATORS 1/2 KW thru 2000 KW

Yours for the Asking

WRITE DEPT. 21, WAUSAU, WIS.



A Complete Condensed Catalog of Motor Prices & Dimensions with NEMA New-Old Frame Cross-Reference List.

SINCE 1913

MARATHON ME ELECTRIC

HOME OFFICE AND FACTORY, WAUSAU, WIS. FACTORIES AT ERIE, PA. AND EARLVILLE, ILL.

SALES OFFICES IN PRINCIPAL CITIES

Circle 21A on reply card

delicate staking, crimping and riveting. At 100-psi pressure, it will rivet 5/8-inch diameter mild steel. The tool is reportedly keyed against rotation and its collet is precision fitted. It will repeat without wandering or wobbling. A depth stop may be set to limit the work progress.

Circle 10E on reply card

Pressure-sensing metallic diaphragms have been added to Bellofram Products Corporation's line of deep convolution piston seals, molded diaphragm seals and rubber-to-metal bonded parts. The group is offered in two forms, according to the manufacturer: conventional, for

application in altimeters, aneroid barometers, air speed indicators and pressure gauges; and nested, for applications requiring over-pressure resistance to absorb great pressure changes that would normally tend to collapse conventional metallic diaphragms. Each element is resistance welded. The devices are available in both Ni-Span "C" and 17-7PH, as well as in other stainless steel alloys and selected weldable metals. They range in size from less than 1 inch to more than 3 inches in diameter.

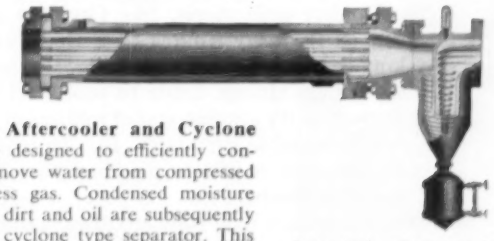
Circle 11E on reply card

The Garlock Packing Company is offering shredded metal packings known as Styles 934 and 935 for use under extremely high steam pressures and temperatures to 1500°F. They are made of copper tinsel, treated with special rubber cements, graphited throughout, molded to shape and cut open with a beveled joint. Number 934 is available in ring form only, usually molded to approximately a square cross section and bevel cut, while the other is a packing set consisting of conical-shaped molded center rings with an included angle of 120 degrees and bronze top and bottom adapters. Other metal adapters are available to customers' specifications. According to the manufacturer, both may be used in steam, air, water or gases (except ammonia) applications on valve stems, reciprocating rods, and rotary shafts of pumps, blowers, compressors and similar equipment.

Circle 12E on reply card

Aftercooler and Cyclone Separator designed for cleaner, dryer compressed air

R. P. ADAMS CO., INC.
209 East Park Drive, Buffalo 17, New York



The Adams Aftercooler and Cyclone Separator are designed to efficiently condense and remove water from compressed air and process gas. Condensed moisture and entrained dirt and oil are subsequently removed in a cyclone type separator. This unit is scientifically designed for maximum removal efficiency over a wide range of flow rates.

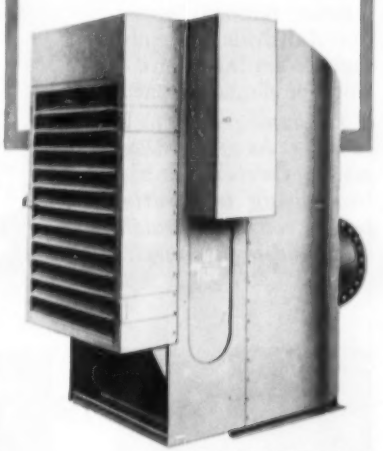
For normal use, units are available to cool gases to within 10° F of the temperature of the cooling water. Specially designed units are available to permit a 2° F approach to cooling water temperature, for application where low moisture content is critical.

Adams Aftercoolers and Separators are available from stock to handle 20 - 40,000 cfm with 10° cooling and 25 - 19,200 cfm where it is necessary to cool within 2°F of the cooling water. Special units can be supplied to suit an unlimited range of requirements. In all cases the maximum pressure loss at rated capacities is ½ psi.

This wide range of sizes enables the economical utilization of Adams Aftercoolers and Separators in virtually all industrial application. For further information on how R. P. Adams' units will solve your compressed air problems and save you money, write today for Bulletin 711.

Circle 22A on reply card

AAF Multi-Duty Filters Assure Clean Intake Air Automatically



Type CMS Multi-Duty for air volumes of 3000 CFM and up.

When your engines and compressors are protected by AAF Multi-Duty Self-Cleaning Filters, you *know* that intake air is *clean.*

Uniform air delivery, constant efficiency, low operating resistance and infrequent maintenance are "musts" for true dust protection. Multi-Duty measures up on every count because this filter keeps itself "fit" through continuous self-cleaning action.

Would you like more information? Write today for our 16 page illustrated catalog.

AAF
Herman Nelson

American Air Filter
COMPANY, INC.
402 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

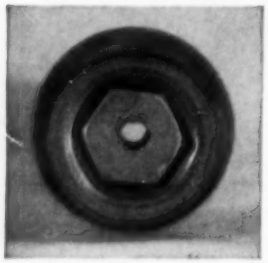
how to get the most out of HOLLOW DRILL STEEL

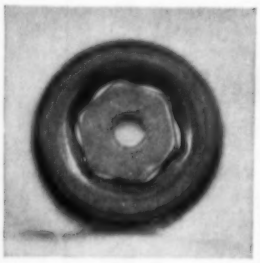
Modern drill rods – especially new *alloy* hollow drill rods like Crucible CA DOUBLE DIAMOND or 4E – give longer drill life than was possible with straight carbon rods. They'll give you lower cost per foot of hole drilled on the job. They will, that is, if you let them. For *abuse* will stop even the best steel from doing its best job. And you pay the price in higher drilling costs.

Take, for example, MAINTENANCE:

DRILLS — Pneumatic drills are often so badly in need of repair that good drilling is impossible. Early failure of any rod used in these drills is inevitable. The solution is regular, periodic inspection of all drills and equipment – replacement of worn or damaged parts.

The damaged and worn striking faces of these pistons prevent impact from being transmitted to the rod in a straight line. Rod failure results.





RODS — It's a temptation to store drills by throwing them into one big pile. Resist it. For nicks and surface damage result – drill failures occur at points of damage.

Rods properly racked and stored give better service.

BITS — Keep bits sharp. A dull bit binds in the hole, and drills so slowly that little useful work is performed. But the drill steel must absorb the rugged blows of the hammer.

Proper bit maintenance pays off.

It pays big dividends to make good maintenance a habit. Quality drill steels, like Crucible CA DOUBLE DIAMOND or 4E Alloy Hollow Drill Rods, are made to give long service, lowest cost per foot of hole drilled. They're tough, strong, made to tool steel standards. This *extra* quality assures you of minimum rod breakage, fewer valuable bit losses. But to bring out the best in 'em, you've got to do your part by keeping equipment in shape.

Crucible hollow drill rods are always quickly available in the sizes and types you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Circle 24A on reply card

BRIEFS

A new passenger ship was recently proposed to the Maritime Administration in an appeal for construction differential subsidy aid. The Great Lakes/Oceanic Line, Inc., Detroit, Mich., proposed to acquire a type C4 troopship from the Maritime Administration and to reconstruct it as a 600-passenger vessel. It would be put into service in the Great Lakes on a fixed route between Canadian and United States ports in summer; and in winter, would operate out of New Orleans, La., as a cruise ship. The vessel would provide single-class accommodations, and its estimated reconversion cost is $9,000,000.

The development of a louver-type fish screen, said to be one of the outstanding developments in fishery conservation in the last 30 years, has won for three Department of the Interior employees an incentive award of $12,000. The award is the third largest ever made by the government and the largest ever awarded by a non-military agency. The screen is described as "a venetian blind with perpendicular slats" and is designed to guide millions of young fish away from diversion works on the nation's rivers and streams.

The Atomic Energy Commission announced September 3 that it had shipped its 100,000th package of radioisotopes from the Oak Ridge National Laboratory. The radioisotopes program was inaugurated some 11 years ago. The first shipment was made to the Barnard Free Skin and Cancer Clinic, St. Louis, Mo. Shipment number 100,000 consisting of 75 millicuries of Potassium 42 was sent to the University of Iowa, Iowa City. Both shipments were used for medical research. More than 4000 organizations are now licensed to use radioisotopes.

A geological discovery considered to be a scientific sensation was made recently by a Swedish mine cruiser carrying equipment for a Swedish-Finnish-Swiss geophysical expedition in connection with the International Geophysical Year. Sounding equipment located a previously unknown subaqueous mountain peak. Located in Murchison Bay, the mountain soars from a maximum depth of 6000 feet to a minimum of 60 feet.

Anti-litter campaigns throughout the United States affect more than the cleanliness and attractiveness of our surroundings; they affect our pocketbooks. New York State alone has reported that cleaning the highways costs about

MORE GALLONS

If your liquid moving problem is primarily a matter of pumping efficiency . . . more gallons per kilowatt hour . . . then you should get the facts about Ingersoll-Rand's line of Motorpumps.

Its high efficiency results from a well-designed and expertly finished impeller and casing . . . carefully selected for each job from the most extensive line available . . . a good stuffing box or mechanical seal . . . and the best brand name motors.

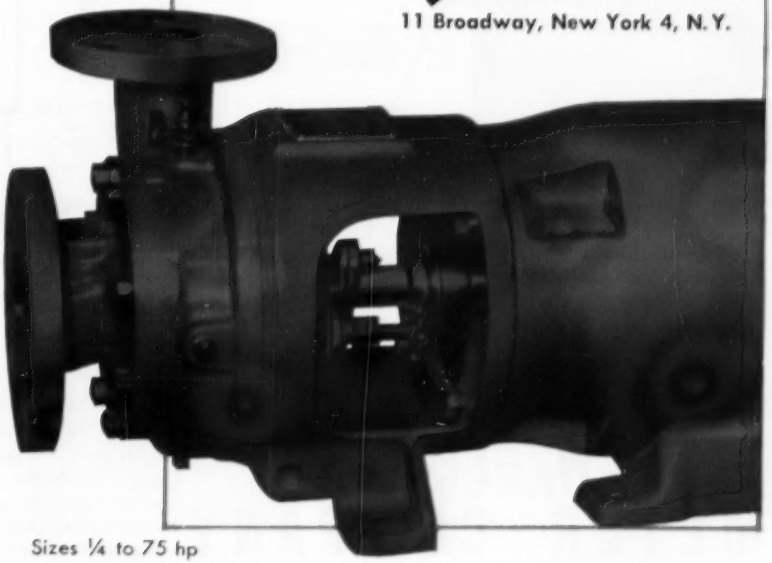
In addition, the powerful Motorpump is built for long life, low maintenance and operating dependability. Get complete information by contacting the local Ingersoll-Rand branch office or write for a complete bulletin.

MOTORPUMP

by

Ingersoll-Rand

11 Broadway, New York 4, N.Y.



Sizes ¼ to 75 hp
—capacities to 2800 gpm
—heads to 650 feet

9-591

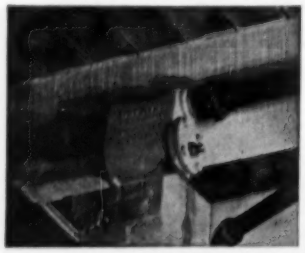
Circle 25A on reply card

DEPENDABLE PNEUMATIC SERVICE

WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper — resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY METER COMPANY

PLAINFIELD, NEW JERSEY

Circle 26A on reply card

---

new...

pre-lubricated take-up bearings

SLASH maintenance costs

Pre-Lubricated At Our Factory For Life • Seals Lubricant In—Dirt Out • Standard Series Ball Bearings • Self-Aligning • Frames of Welded Structural Steel • Can be Operated in Tension or Compression

T. B. WOOD'S SONS COMPANY

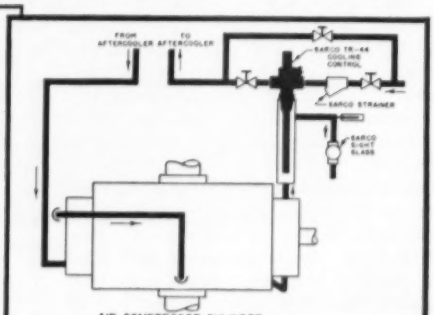
CHAMBERSBURG, PA.

Cambridge, Mass. Newark, N. J. Cleveland, O. Atlanta, Ga. Dallas, Texas

"Our 100th Anniversary"

Circle 27A on reply card

Sarco Type T-44 Self-Powered Cooling Control



Typical applications: compressors, small engines, oil coolers, water-cooled rolls, condensers, etc.

PROTECT COMPRESSORS

against undercooling and overcooling

Undercooling cuts down compressor capacity . . . often damages cylinders, other parts.

Overcooling increases wear, destroys lubricants, wastes water.

You can avoid these troubles, step up the performance of your compressors, reduce maintenance, save water and lubricants. How? By replacing uncertain manual control of cooling water . . . by *automatic* control with Sarco self-powered temperature regulators.

½" size . . . only about $37

Inexpensive. Simple. Require no outside power source. Packless. Easy to install by any pipefitter.

Write for Bulletin 710B. Sarco Co., Inc. 635 Madison Ave., New York 22, N. Y.

SARCO

Circle 28A on reply card

$1,500,000 annually. Long Island highways are the worst offenders with a per-mile cost of $401, while the rest of the state has a like cost of $78. Dollars for the project come directly from the taxpayer.

The Pennsylvania Turnpike Commission is planning to open the final portion of the Northeastern Extension for traffic at noon, November 1. A 94½-mile section of the extension has been open since April 1. The remaining section of 15½ miles had originally been scheduled to open September 15, but material shortages caused a 6-week delay.

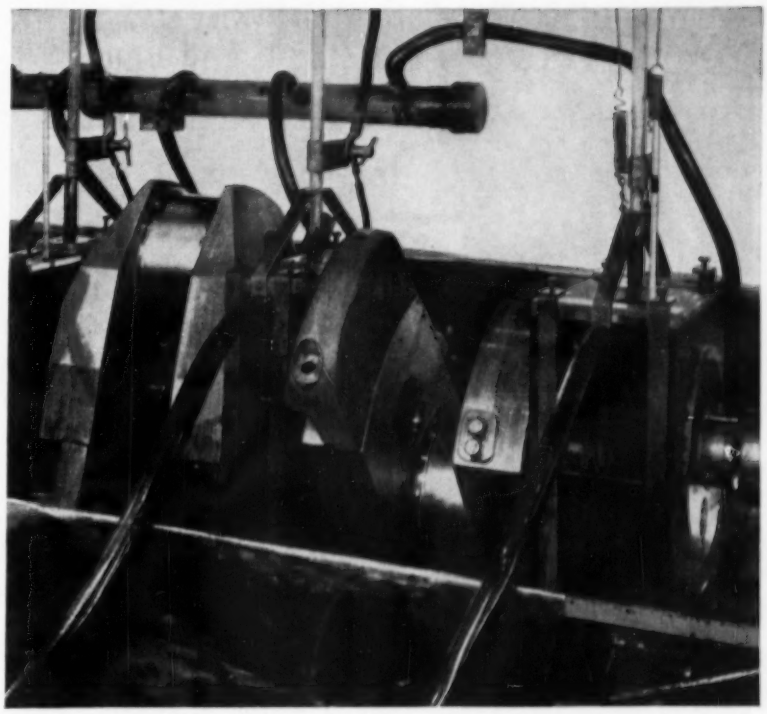
E.I. du Pont de Nemours & Company buys many strange items for its production processes. Enough purified water—1½ billion gallons—is used in a year to keep Niagara Falls flowing for almost 5 minutes. Another item on the purchase list is vinegar, for cleaning book covers. One hundred yards of tinsel is needed to eliminate static electricity on cellophane during manufacture.

Allegheny Ludlum Steel Corporation has placed in operation, at its Watervliet, N. Y., plant, what is believed to be the world's largest vacuum furnace. The new installation is capable of producing 26-inch-diameter ingots weighing up to 12,-000 pounds. The furnace uses consumable electrodes.

Corneas from human eyes, considered one of the most fragile parts of the body, have been preserved successfully for as long as 2 years. The delicate tissue, removed as soon as possible after death, is dehydrated in glycerin and stored at room temperature in vacuum sealed tubes. Thin layers of corneal tissue have been successfully used to restore sight to people whose own corneas were injured.

New York State is planning a prestressed concrete girder highway bridge that will set a new United States span record for bridges of that type. Having an over-all length of 470 feet, the bridge's center span will stretch for 320 feet. The structure will be six lanes wide.

Taking the cue from the British method of carrying oil, the U. S. Navy is towing plastic bags behind its vessels, increasing the quantity of liquids that can be transported. Unlike the English parcels, these travel below the water's surface to eleviate the effect of heavy seas. Reportedly, they have little effect on either the cruising speed or fuel consumption of the towing ship.

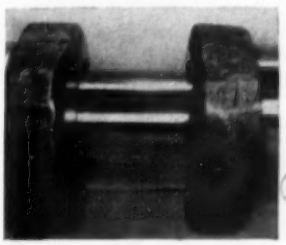


THIS REBUILT CRANKSHAFT IS CHROMIUM PLATED BY A SPECIAL NATIONAL FORGE PROCESS

When your crankshaft is reconditioned at National Forge, here's how it is chrome plated. Each bearing surface is individually boxed and plate thickness is built up only as required. Different thicknesses—over ⅛" if needed—can be added to different surfaces of the same crank. Because only the boxed surfaces are exposed to plating action the fillet areas retain their original strength.

When applied by National Forge specialists, chrome plating is uniform and smooth. Regrinding is kept to a minimum and your reconditioned crankshafts are returned to you meeting the original shaft's specifications.

No other plating company has National Forge's experience in handling both new and rebuilt crankshafts. So why not try National Forge specialists on your crankshaft rebuilding jobs?



This is a finished, repaired crankshaft after processing by National Forge.

For more details on crankshaft repair, write for Bulletin RC-4.

NATIONAL FORGE
AND ORDNANCE COMPANY
IRVINE, WARREN COUNTY, PA.

Circle 29A on reply card

in steam and vapor
300 LIFTS per hour
for 12 years

overhead air hoists set new performance records

Since 1945 two Ingersoll-Rand Overhead Air Hoists have been continuously used by a firm in cleaning 55 gal. drums. These drums are slung beneath the hoists and lowered into a cleaning bath consisting of hot water and strong wetting and cleaning agents. As a result, clouds of steam and vapor practically obscure the hoists at all times. And except for minor repairs and standard maintenance, these hoists have never stopped.

Dependability and rugged construction are just two of the reasons why more and more plant men are specifying Ingersoll-Rand Air Hoists. These other important advantages contribute to long life and easier, safer operation:

Automatic Brake—holds the load automatically

Automatic Safety Up-Stop—shuts off air, stops motor before load reaches hoist

Graduated Reversing Valve—instant and complete control of hoisting action

Poppet Throttle Valve—prevents air leakage when hoist is idle

Pendent Throttle—The only complete line of air hoists with convenient "one hand" control.

Ingersoll-Rand Overhead Air Hoists are available in many types and sizes. Capacities range from 200 lbs. to 24,000 lbs. Your I-R AIRengineer can point out how these air hoists can give you new hoisting economy. Call him today, or write direct for catalog data.

8-530

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

Circle 30A on reply card

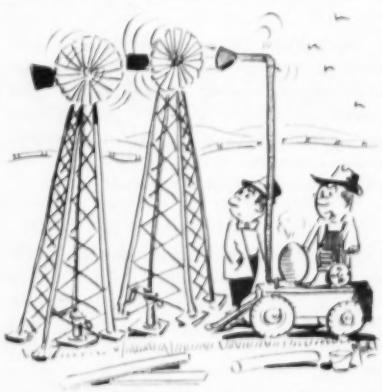
Industrial Books and Literature

Centrifugal and Axial Flow Pumps by A. J. Stepanoff was first published in 1948. Since then it has become the definitive text on the theory, design and application of these pumps. Dr. Stepanoff, a development engineer for Ingersoll-Rand Company and an authority on centrifugal pumps (Melville Medalist, A.S.M.E.) has revised his work; this year, the second edition was published by John Wiley & Sons, Inc.

The author's justification for the revision is twofold, arising in the first instance from the fact that during the past 9 years, the application of centrifugal pumps has been extended to new fields. Thus, new hydraulic, mechanical, metallurgical and manufacturing problems have been created. Secondly, Dr. Stepanoff states that "considerable progress was achieved during the same period in the theoretical aspects and design procedure based on a better understanding of the flow processes through the parts comprising a centrifugal pump."

Features from the first edition that made it especially valuable to design and operating engineers have been maintained and in some instances, revised in the second. They include theoretical and experimental studies of such subjects as cavitation, operation outside the normal head-capacity and speed ranges, axial and radial thrust, the effect of stuffing boxes on the critical speed of pump shafts, the control of head-capacity and brake-horsepower curves, and the pumping of viscous liquids. Considerable space is devoted to special problems of pump design and application, and numerous examples of modern pump designs and installations are given.

A new chapter—"Water-Hammer Problems in Centrifugal Pump Systems"—has been added, and the section detailing centrifugal jet-pump systems has



"We haven't enough wind out here to run two windmills, so I had to buy an air compressor to run one."

been expanded and rewritten. Illustrations, in many instances, have been replaced with more recent photographs and diagrams. A viscosity correction chart has been included to cover a wider range of pump types than was available in the former edition.

Even with the extensive changes and vast, general minor improvements, old chapter numbers and titles have been retained so that readers familiar with the first edition will be able to follow the second, as a reference book, without difficulty. It is interesting to note that the first edition was translated into Japanese, and that plans are in progress to translate the second into German.

Like the first edition, the book is sufficiently technical for the most exacting of design engineers; yet, it may be read with profit by those concerned with the practical solution of pumping problems. Copies are available from the publisher, 440 Fourth Avenue, New York 16, N. Y. Cost, $12.00.

Fifty-nine shortcuts to speed drafting and computation work are detailed in *Time Saving Tips*, published by Frederick Post Company. Clearly written and well illustrated, this booklet shows new approaches to old problems. A section on calculating ideas contains ten tips, including easy ways of remembering the signs of trig functions, dividing a circle into parts and locating decimal points. Copies may be obtained free of charge and should be of value to engineers, students and draftsmen.

Circle 13E on reply card

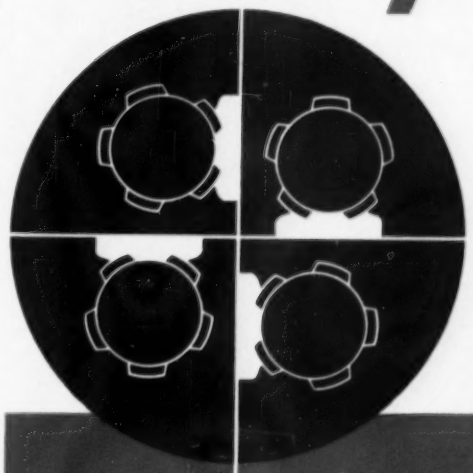
Features of an easily operated, accurate, portable 30-ounce instrument that can reportedly be used in any position to test the hardness of any size, shape or type of metal are covered in a folder issued by Newage Industries, Inc. The entire hardness scale of each tester is matched to a complete range of Master Rockwell or Brinell blocks by means of hand calibration. Accuracy of plus or minus 1.5 points on the Rockwell scales and 5 on the Brinell scale is reportedly assured. *Circle 14E on reply card*

Improved Copel copper-nickel resistance alloy developed for use on "cold" resistor applications in electronic devices, precision instruments and similar apparatus where mechanical stability and a known low coefficient of resistance are required, is detailed in a catalogue by Hoskins Manufacturing Company. The booklet, M-56C-N, contains complete specifications and price information on 54 wire and 31 ribbon sizes offered as standard.

Circle 15E on reply card

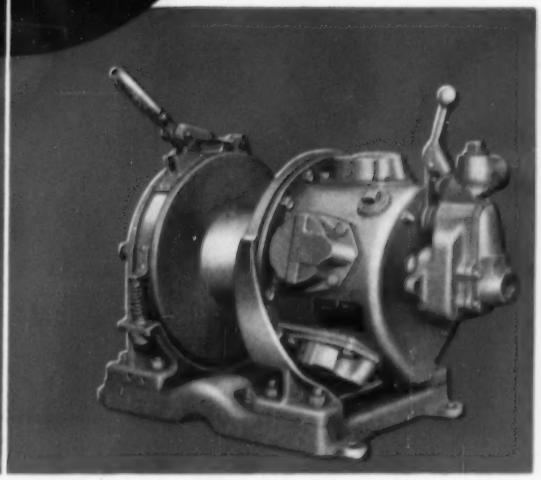
Quick-Flex thermostatic steam traps for all outdoor and nonfreeze service are described in Bulletin No. 257 published

...any way



you look at it...

this is your BEST BUY in



"UTILITY" AIR HOISTS

Pioneered by Ingersoll-Rand

Mounts in any position your job requires. Easily dolly-mounted for portability. This complete line of winch-type Ingersoll-Rand Single Drum "Utility" Air Hoists meets every hauling and hoisting need for loads from 750 to 4000 lbs. Backed by dependable Ingersoll-Rand engineering for long, trouble-free service and high efficiency.

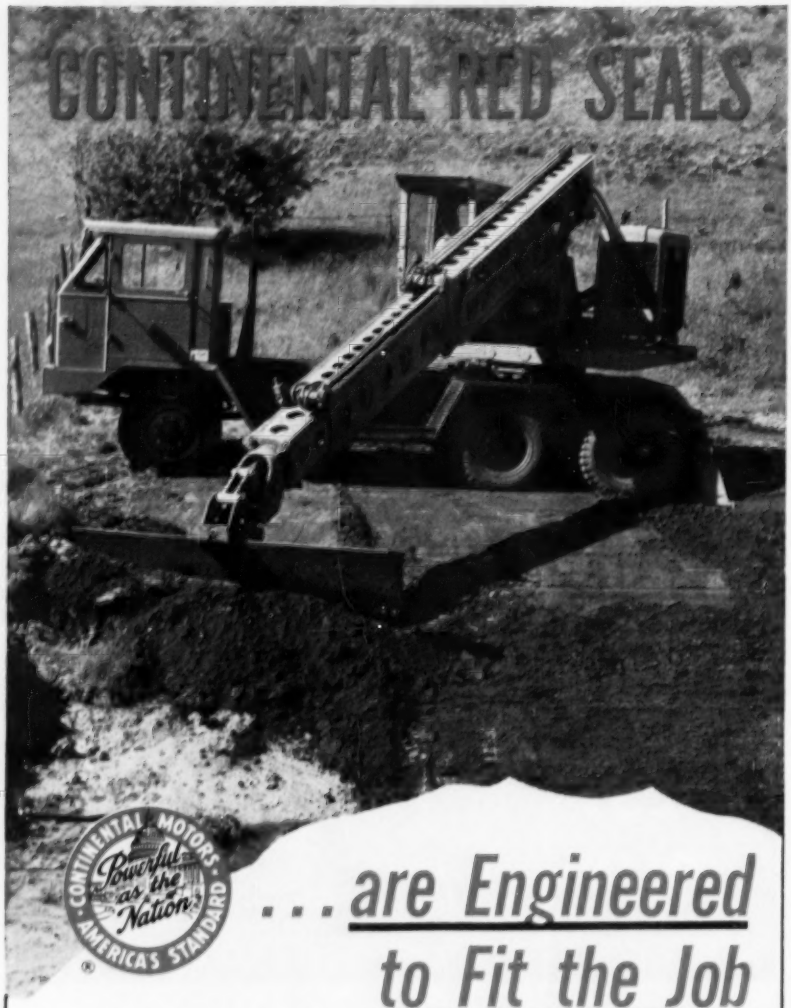
For applications requiring small or heavy-duty overhead hoists, check the Ingersoll-Rand hoist line for capacities up to 24,000 lbs.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

8-534

Circle 31A on reply card



...are Engineered to Fit the Job

You find Red Seals on the job, wherever there's a job to be done—in excavating, ditching, concrete ripping, grading, building, and all phases of road construction. You find them powering the equipment of manufacturers who recognize the importance of the "engineered for the job" features, and the day-in, day-out dependability of Continental Red Seal engines and power units. . . . .The Badger Machine Company's Model 360 Hydro-Scopic Hopto, shown above, is powered by a Continental Red Seal Model B427. This installation is another fine example of expert matching of the engine to the rest of the machine. It's wise, when buying equipment of this type, to choose a make with Red Seal power. You get an engine which is not only tailored to the job, but backed by specialized experience dating from 1902.

SERVICE FACILITIES AND GENUINE RED SEAL PARTS ARE AVAILABLE EVERYWHERE

WORLD'S LEADING INDEPENDENT MANUFACTURER OF INTERNAL COMBUSTION ENGINES, CONTINENTAL MOTORS OPERATES PLANTS IN ATLANTA, DALLAS, DETROIT, MILWAUKEE, MUSKEGON, AND TOLEDO, AND IN ST. THOMAS, ONT., PRODUCING AIR-COOLED AND LIQUID-COOLED ENGINES FOR USE ON LAND, AT SEA AND IN THE AIR.

Continental Motors Corporation

MUSKEGON • MICHIGAN

Circle 32A on reply card

by the V. D. Anderson Company. It itemizes such typical uses as tracer and drip lines, meter boxes and other outdoor steam processing equipment found in chemical, refinery, solvent, greenhouse, and such similar operations. Specifications, capacities and dimensional drawings for the devices are given.

Circle 16E on reply card

Bulletin No. P1271 describing and illustrating a line of small-size self-balancing electronic potentiometers and bridges has been released by The Bristol Company. The instruments are made in both recording and indicating versions, and plug-in construction features make the two types of chassis interchangeable. They are available in a-c bridge, d-c potentiometer and differential-transformer balance basic circuit varieties.

Circle 17E on reply card

How to handle thermal expansion and contraction in piping with ball joints is outlined in a 6-page bulletin (No. 31) published by Barco Manufacturing Company. Illustrations of four basic motion principles of ball, swing, swivel and revolving joints provide the key to the various examples of how to provide safe flexibility in service lines subject to severe contraction and expansion.

Circle 18E on reply card

A heavy-duty, high-capacity gas thermostat for use in commercial and industrial equipment is described in Bulletin No. RT-815, offered by Robertshaw-Fulton Controls Company. Model CTS, as it is called, is of the snap-acting type and is available in temperature ranges to 550°F. It is designed for use where quick response to temperature change is required.

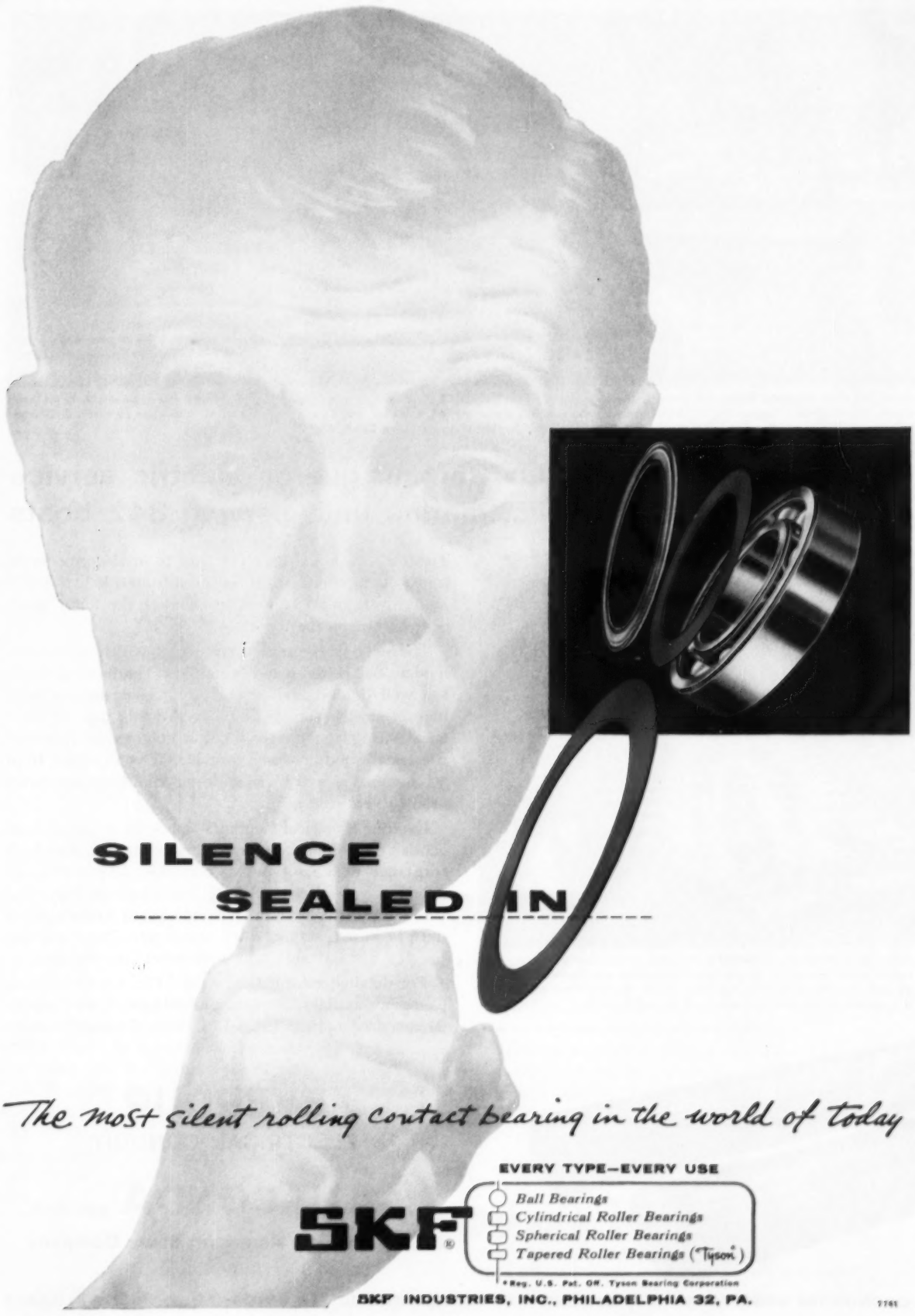
Circle 19E on reply card

Technical data and installation information about unplasticized polyvinyl chloride (PVC) pipe are provided in a booklet available from Tube Turns Plastics, Inc. The substance is said to be a low-cost, corrosion-resistant material with good structural strength and dimensional stability. Complete specifications are given for threaded and socket fittings, valves and flanges made of both normal and high-impact material. The booklet contains pressure-temperature charts, chemical resistance tables and support spacing formulae.

Circle 20E on reply card

An 8-page booklet about plastic pipe and fittings includes complete tables on pressure drop through it, pressure-temperature ratings for different sizes and recommended pumping depths. It is published by Crane Company and lists three grades of polyethylene pipe: standard wall, 75-pound and 100-pound.

Circle 21E on reply card



The most silent rolling contact bearing in the world of today

EVERY TYPE—EVERY USE

SKF®

- *Ball Bearings*
- *Cylindrical Roller Bearings*
- *Spherical Roller Bearings*
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*Reg. U.S. Pat. Off. Tyson Bearing Corporation

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

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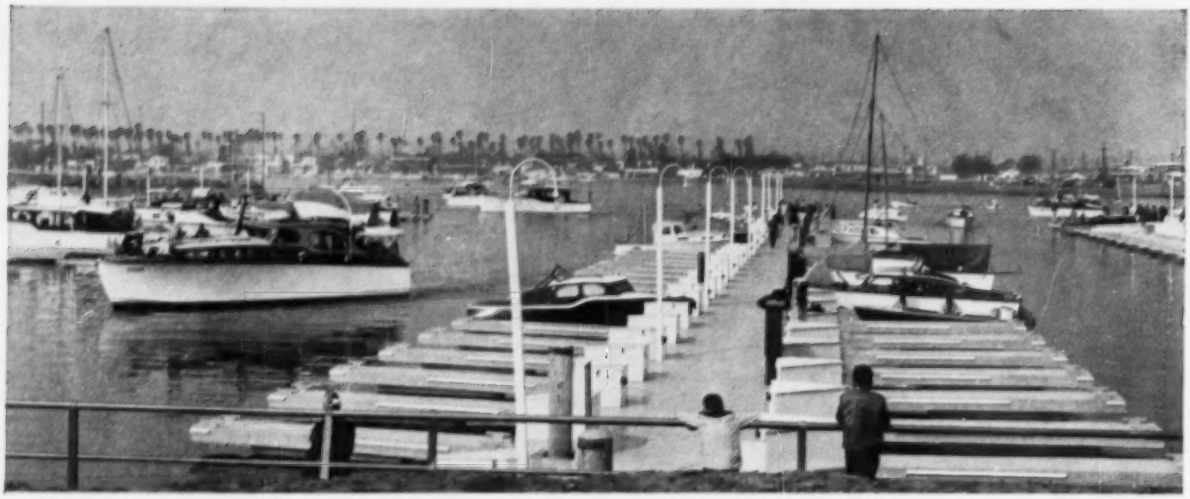
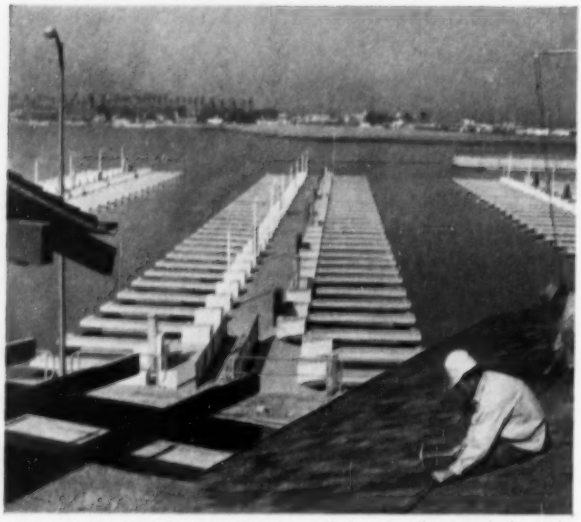


ALAMITOS BAY MARINA BASIN #1, built by the City of Long Beach, Calif: S. E. Vickers, city manager; J. D. Gilkerson, city engineer; B. E. McCune, deputy city engineer; Thomas G. Marchese, project engineer. Engineers: Moffatt & Nichol Inc., Long Beach. Electrical contractor: Ets-Hokin & Galvan, Wilmington, Calif. Everdur Conduit furnished by General Electric Supply Company, Long Beach, Calif.

Over two miles of Everdur Conduit guards electric service at new Long Beach, Calif., marina unit, serving 342 boats



EVERDUR ELECTRICAL CONDUIT is installed under floating docks, only inches above the water. Plug-in electrical outlets are located at lockers by each slip and on lighting standards. *Below:* Everdur Electrical Conduit is available in two wall thicknesses—R. C. and E. M. T.

PHOTOS COURTESY INDEPENDENT-PRESS-TELEGRAM, LONG BEACH, CALIF.

The City of Long Beach, Calif., is in the process of transforming its Alamitos Bay area from tide flats and a massive mosquito factory into one of the finest small boat harbors in the world.

The first boat basin and marina unit, which can accommodate 342 boats, is now complete. The floating docks are well lighted and at each slip, boat owners have plug-in electric service and a fresh water tap. All electrical wiring from the shore out is protected by Everdur® Electrical Conduit – well over 11,000 feet, ranging from ½" nominal size to 3". In addition, all fittings and boxes are of Everdur.

Everdur Electrical Conduit – made from one of Anaconda's copper-silicon alloys—never rusts and offers high resistance to other types of corrosion. It provides dependable year-after-year protection wherever water and corrosive atmospheres are a problem – or where conduit must be buried or embedded in concrete. Everdur is also tough – it stands up under movement and vibration.

For detailed information, write: The American Brass Company, Buffalo Division, Buffalo 5, N. Y. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

87136A

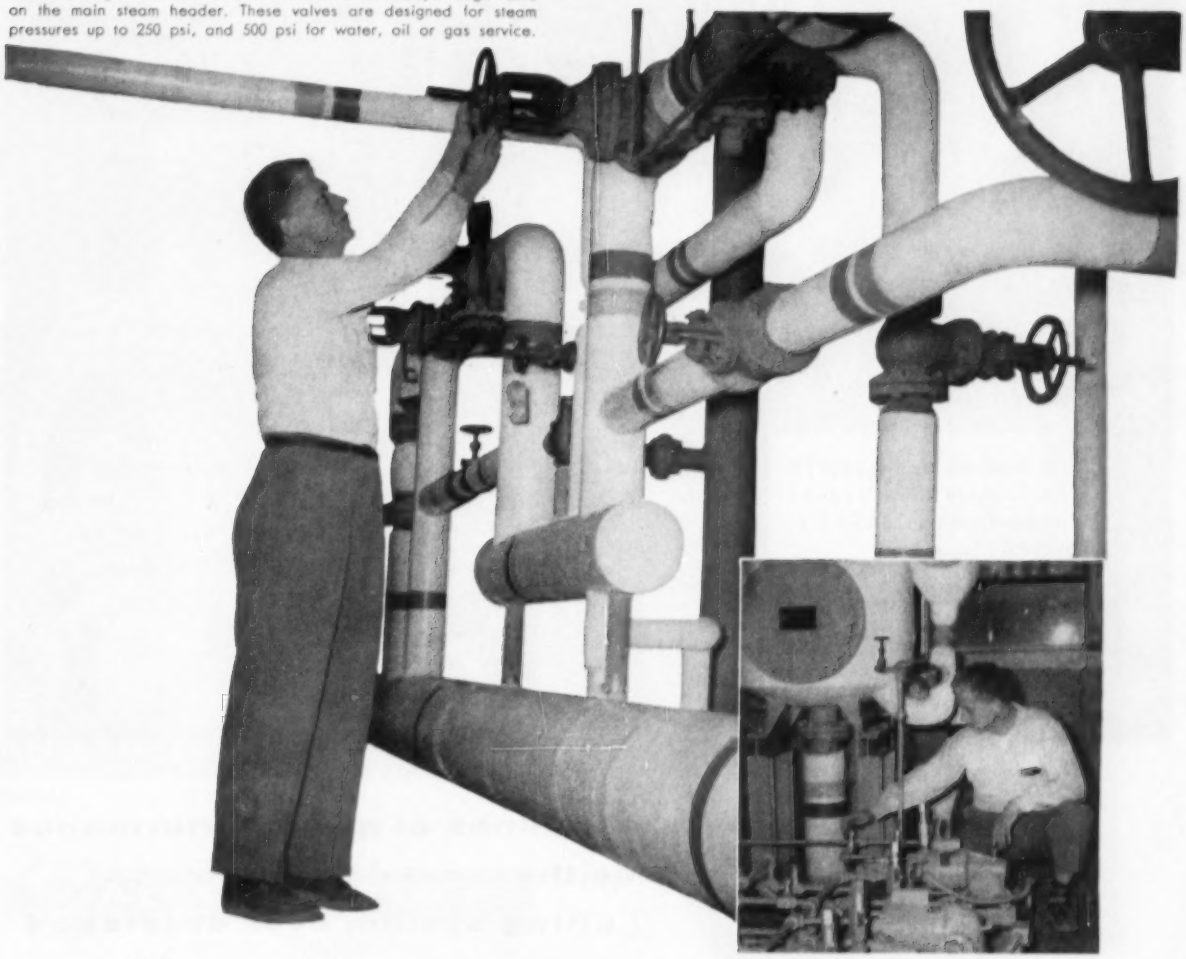
EVERDUR
ELECTRICAL CONDUIT

an **ANACONDA®** product

made by The American Brass Company

CORROSION RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE

The Chief Engineer closes an 8-inch Walworth Iron Body Wedge Valve on the main steam header. These valves are designed for steam pressures up to 250 psi, and 500 psi for water, oil or gas service.



Chief Engineer Bruce W. Martin checks Walworth Bar Stock Valves in chemical feed pump lines to boiler and feed water. These carbon steel valves are built for ratings up to 3000 psi. Stainless steel bar stock valves are also available for very severe service.

"from big gates to little globes"...

The power plant at the Michigan School for the Deaf has an operating capacity of 25,000 lbs. per hour generated by three 200 hp and one 60 hp oil-fired boilers. Built four years ago, the plant is now the responsibility of Chief Engineer Bruce W. Martin who says: "This plant was designed and constructed for efficient operation, and a lot of that efficiency depends on the valves. From big gates to little globes installed here, we use a wide variety of Walworth Valves. They give us the dependable, trouble-free service we want and expect. I would recommend them to anybody for similar service."

Walworth's complete lines of valves are built to provide long range service and savings. There's a Walworth Valve in a type, size, and material to serve you . . . Gate, Globe, Angle, Check, and Lubricated Plug Valves in a variety of pressure ratings. The next time you need valves or have a problem concerning flow control, call your Walworth Distributor, or, write Walworth direct.

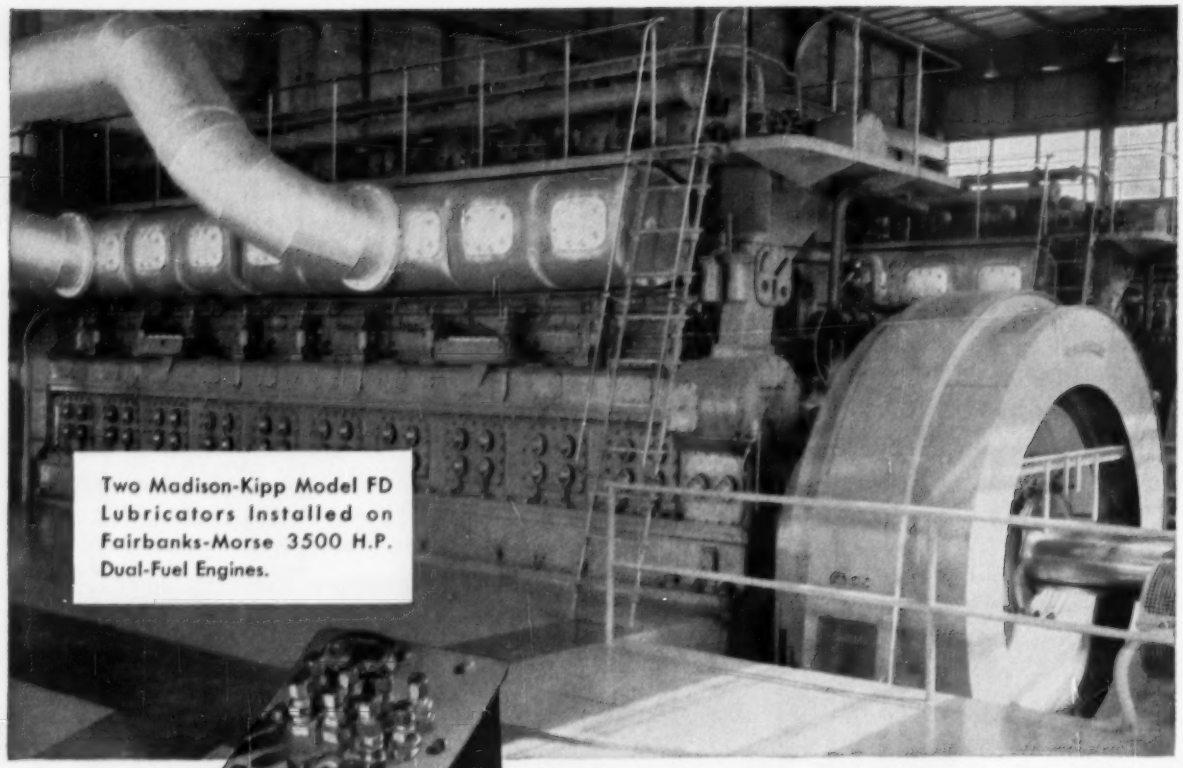
WALWORTH

60 EAST 42nd STREET, NEW YORK 17, N.Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

WALWORTH SUBSIDIARIES: ALLOY STEEL PRODUCTS CO. • CONOFLOW CORPORATION • GROVE VALVE AND REGULATOR CO. M&H VALVE & FITTINGS CO. • SOUTHWEST FABRICATING & WELDING CO., INC. • WALWORTH COMPANY OF CANADA, LTD.

Circle 35A on reply card.



Two Madison-Kipp Model FD Lubricators Installed on Fairbanks-Morse 3500 H.P. Dual-Fuel Engines.

Machines of great performance use the most dependable oiling system ever developed

MADISON-KIPP

Fresh Oil

...by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy, where oil under pressure fed drop by drop can be installed. There are 6 models to meet almost every installation requirement.

kipp

MADISON-KIPP CORPORATION
202 WAUBESA STREET • MADISON 10, WIS., U.S.A.

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

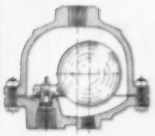
Circle 36A on reply card

PROTECT COMPRESSED AIR TOOLS

Your Guide to Correct Air Trap Selection

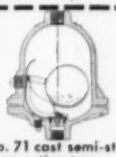
For automatic draining of water from compressed air or gas systems.

Line Drips—
No. 21 direct acting ball float trap is recommended for most installations. Direct acting... most commonly used trap.



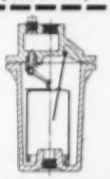
No. 21 cast semi-steel Air Trap

Air Line Separators—
If free from oil or sludge, use No. 71 snap-action trap. Spring-loaded valve snaps wide open and shuts tight. This action is particularly desirable when liquid load is light. Grit will not lodge between valve and seat.



No. 71 cast semi-steel snap-action trap.

Intercoolers, Aftercoolers, and Large Receivers—
Usually contain heavy oil or sludge that fouls up any ball float trap. Use No. 213 inverted bucket trap with a scrubbing wire to provide positive drainage and freedom from maintenance.



No. 213 inverted bucket trap with scrubbing wire. Also forged steel models for pressures above 250 lbs.

Ask for free Bulletin No. 2022 . . . see your local Armstrong Representative or write: Armstrong Machine Works 8855 Maple St., Three Rivers, Mich.

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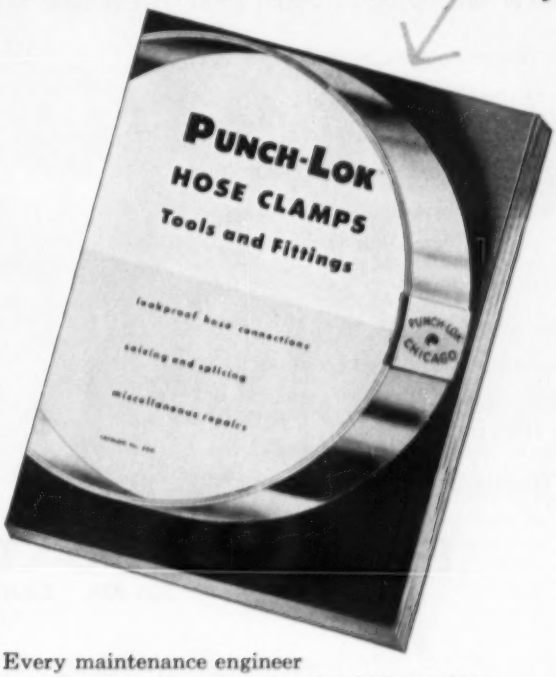

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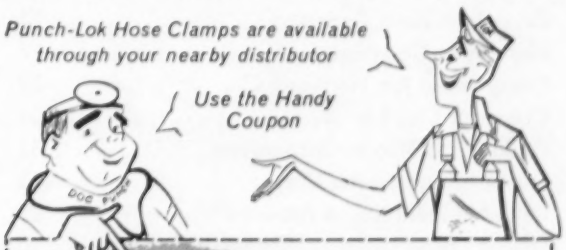

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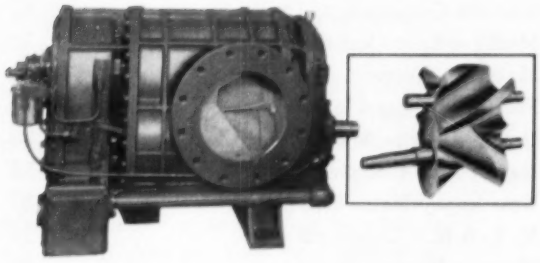

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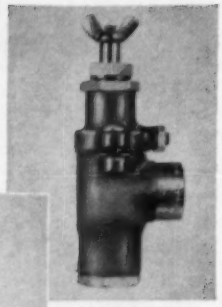
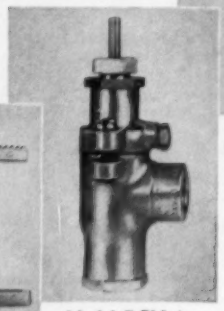
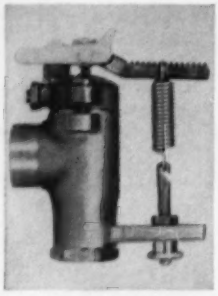


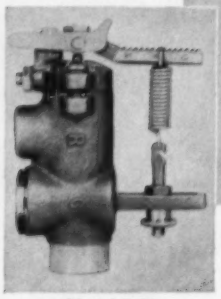
Model RCM-A with hand unloader



Model RCM-A



Model RCF



Model RCS (Available with drain cock)

R. CONRADER CO. INC.

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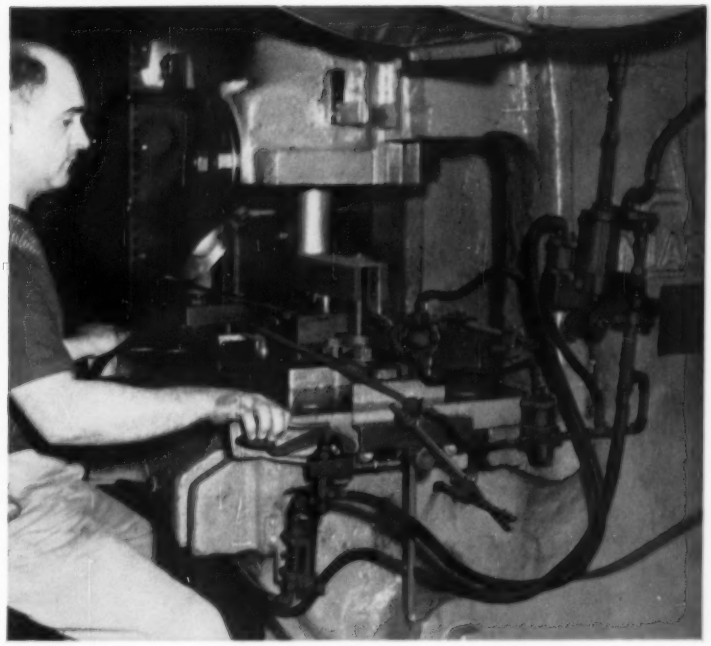
For automation and safety... Schrader Packaged Air Sets upgrade machine tools



Punch press will not operate unless both hand valves are pressed at once. The press cycle cannot be repeated until the hand valves are released and the pilot cylinder is vented to atmosphere by the cam valve. A cutout valve prevents continuous press operation with one hand valve tied down. Air ejection is accomplished by cam action that actuates air column. Safety first with a Schrader Packaged Air Set.

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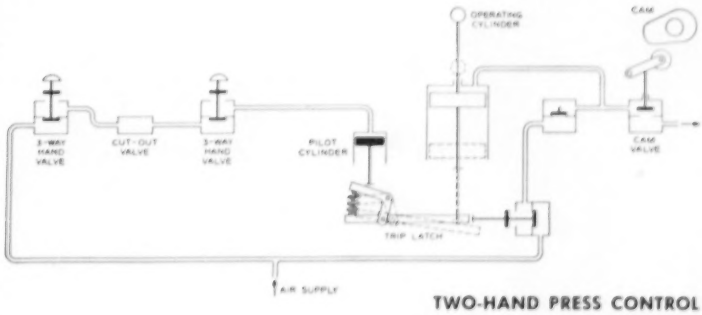

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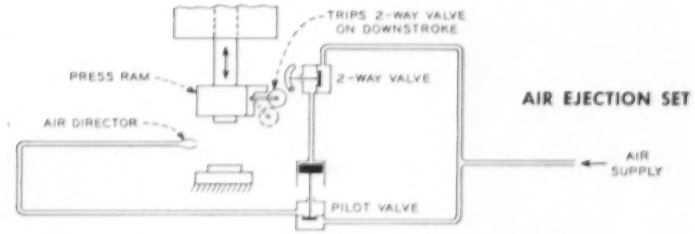

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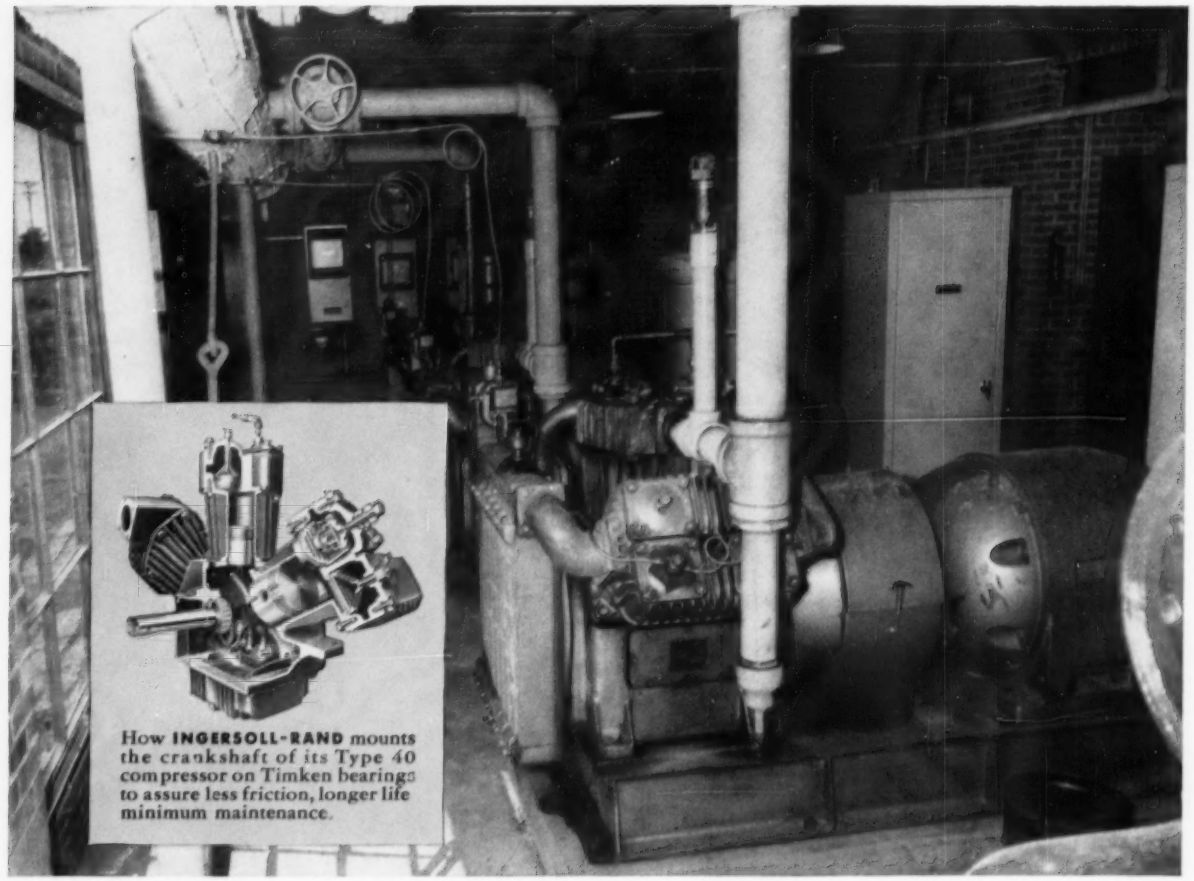
How INGERSOLL-RAND mounts the crankshaft of its Type 40 compressor on Timken bearings to assure less friction, longer life minimum maintenance.

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IN classification yards where modern freight trains are assembled, cars are rolled down a hill called a hump. Braking is done by means of a flange that moves beside the track to rub against the wheel. The flange is moved by compressed air. If the air pressure is low, the flange can't push hard enough. The freight car bangs into other cars and lading is damaged.

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